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PROCEEDINGS: CONFERENCE IN THE MATTER OF POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES. FIFTH SESSION. HELD AT LAS VEGAS, NEVADA ON MAY 26, 1964

Public Health Service
Washington, D.C.

26 May 1964

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PROCEEDINGS

CONFERENCE *in the matter of* POLLUTION *of the Interstate Waters of the* COLORADO RIVER *and its Tributaries*

Fifth Session
Las Vegas, Nevada
May 26, 1964

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

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CONFERENCE
in the matter of
POLLUTION
of the Interstate Waters of the
COLORADO RIVER
and its Tributaries

Fifth Session

Convened on the Call of the
Secretary of Health, Education, and Welfare
Under Section 8 of the
Federal Water Pollution Control Act
(33 U.S.C. 466g et seq.)
Las Vegas, Nevada
May 26, 1964

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Washington, D.C. 20201

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Conference in the Matter of Pollution of the Interstate Waters of the Colorado River and its Tributaries, Fifth Session, convened at 9:30 a.m., on Tuesday, May 26, 1964, at the Stardust Hotel, Las Vegas, Nevada.

PRESIDING:

Mr. Murray Stein, Chief, Enforcement Branch, Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.

CONFEREES:

Mr. George W. Marx, Arizona State Department of Health

Mr. Paul R. Bonderson, California State Water Quality Control Board

Mr. Frank Rozich, Colorado State Department of Public Health

Mr. Wallace W. White, Nevada State Department of Health

Mr. Charles G. Caldwell, New Mexico Department of Public Health

Mr. Lynn M. Thatcher, Utah Water Pollution Control Board

Mr. Arthur E. Williamson, Wyoming Department of Public Health

Mr. Lester M. Klashman, U. S. Department of Health, Education, and Welfare, Denver, Colorado

PARTICIPANTS:

Mr. Henry Baty, Radiation Safety Officer, Atlas Minerals Division, Atlas Corporation, Moab, Utah

Mr. Robert G. Beverly, Administrator, Radiation Controls, Union Carbide Corporation, Nuclear Division, Grand Junction, Colorado

PARTICIPANTS: (Continued)

Mr. William P. Copple, Attorney, representing the Governor and Arizona Water Users, P. O. Box 551, Yuma, Arizona

Mr. William T. Davoren, Regional Coordinator, Pacific Southwest Region, U. S. Department of the Interior, 125 South State Street, Room 2209, Salt Lake City, Utah

Mr. Joseph W. Fitzpatrick, Deputy Project Director, Colorado River Basin Water Quality Control Project, Denver, Colorado

Mr. John B. Goff, Metallurgist, AZ Minerals Division, Atlas Corporation, Box 488, Moab, Utah

Mr. Don F. Harmon, Radiation Safety Specialist, U. S. Atomic Energy Commission, Washington, D. C.

Mr. Roswell Jones, Chief, Engineer, Arizona Water Company, 2612 North 16th Street, Phoenix, Arizona

Mr. Maurice N. Langley, Acting Chief, Division of Irrigation and Land Use, Bureau of Reclamation, U. S. Department of the Interior, Washington, D. C.

Mr. Robert P. Lowe, Chief, Water and Sewage Section, New Mexico Department of Public Health, 408 Galisteo Street, Santa Fe, New Mexico

Mr. John M. Rademacher, Project Director, Colorado River Basin Water Quality Control Project, U. S. Department of Health, Education, and Welfare, Denver Federal Center, Denver, Colorado

Mr. Charles E. Sponagle, Director, 1960-64, Colorado River Basin Water Quality Control Project; now Sanitary Engineer Director, Public Health Service Sanitary Engineering Center, Cincinnati, Ohio

Dr. E. C. Tsivoglou, Sanitary Engineer Director, Public Health Service Sanitary Engineering Center, Cincinnati, Ohio

Dr. Nathaniel Wollman, Chairman, Department of Economics, University of New Mexico, Albuquerque, New Mexico

PROCEEDINGS

OPENING STATEMENT

BY

MR. MURRAY STEIN

MR. STEIN: The conference is open.

This conference in the matter of pollution of the interstate waters of the Colorado River and its tributaries, between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and the Department of Health, Education, and Welfare, is being held under the provisions of Section 8 of the Federal Water Pollution Control Act.

for 1964

Under the provisions of the Act, pollution of interstate waters which endangers the health or welfare of persons in a State other than that in which the discharges originate is subject to abatement.

This conference is between the official water pollution control agencies of the States concerned and the Federal Government. Of course, the States and the Federal Government may invite other people to participate in the conference.

For the States the conferees are:

Mr. George W. Marx, of the Arizona State Department of Health;

Mr. Paul R. Bonderson, California State Water Quality Control Board;

Mr. Frank Rozich, Colorado State Department of Public Health;

Mr. Wallace W. White, of the Nevada State Department of Health;

Mr. Charles G. Caldwell, of the New Mexico Department of Public Health;

Mr. Lynn M. Thatcher, of the Utah Water Pollution Control Board;

Mr. Arthur E. Williamson, of the Wyoming Department of Public Health.

Mr. Lester M. Klashman, Department of Health, Education, and Welfare, with headquarters in Denver, Colorado, has been designated as conferee for the Federal Government.

My name is Murray Stein, and I am from Washington, D. C., headquarters of the Department of Health, Education, and Welfare. I am the Chairman and the representative of Secretary Anthony Celebrezze.

The purpose of this conference is to bring together the representatives of the States concerned and the Department of Health, Education, and Welfare to review the existing situation and the progress which has been made; to lay a basis for future action by all parties concerned; and to give the States and localities an opportunity to take any indicated remedial measures under State and local law.

The first session of this conference was held in Phoenix, Arizona, on January 13, 1960; the second session at Las Vegas, Nevada, on May 11, 1961; the third session at Salt Lake City, Utah, on May 9 and 10, 1962; and the fourth session on May 27 and 28, 1963, at San Diego, California.

At the first session of the conference, the Department of Health, Education, and Welfare agreed to undertake, in cooperation with the States, an investigation and study to define the type of pollution problems that might exist in the interstate waters of the Colorado and its tributaries; and to include, among other things, a determination of specific pollutants and their concentration, and methods of securing the best water quality for a multiplicity of uses.

I think the conference technique here has proved most effective. This is a case where we have the most

States and the Federal Government participating in a single conference covering a tremendous river area.

The accomplishments that have been achieved cooperatively, for example, in the field of control of radioactive pollution, with the cooperation of the States, the industries, the Atomic Energy Commission and the Department of Health, Education, and Welfare, have indeed been remarkable and are some of the most outstanding pollution control achievements in the country. It really shows what can be done by cooperative effort.

Last year the conferees agreed that the study group would conduct the following activities:

1. Investigation not only of pollution sources and concentrations, but also determination of feasible measures for protecting water quality for all uses to permit maximum economic growth and development in the Colorado River Basin. Principal emphasis was to be given to studies of salinity (total dissolved solids) conditions in the Basin, specifically:

   a. Investigation and characterization of major sources causing salinity increases.

   b. Investigation of feasible measures by means of which salinity increases could be reduced.

c. Comparative projection of salinity conditions where no reductions are effected and conditions to be expected with various methods of salinity reduction in effect.

d. Determination of economic benefits and costs at various levels of salinity concentrations.

e. Determination of salinity concentrations at which maximum net economic benefits would accrue.

2. Continuation of the Radium Monitoring Network for detection of accidental spills, and evaluation of average radioactivity levels throughout the Basin.

3. Sediment monitoring for gross alpha activity and radium-226 at a reduced number of sampling points.

4. Studies of residual radium-226 contamination at selected places, and the related effect of use of phosphate fertilizers on feed crops and milk.

5. Joint study with the Atomic Energy Commission to develop proposals for the ultimate

disposal of uranium mill tailings, to be considered by the responsible Federal, State and local agencies, and the uranium milling industry.

6. Sampling of all uranium effluents for lead-210 and thorium analyses, with additional sampling where significant contributions are found.

7. Additional sampling and monitoring of San Miguel River sediments in the immediate vicinity of Uravan, Colorado, to evaluate the extent of thorium contamination.

8. Additional sampling of Montezuma Creek water and sediments at Monticello, Utah, to evaluate existing stream quality and effect of site improvement.

9. Preparation by the project staff for submission to the technical committee and, where possible, to the conferees, of a set of basic principles to be used in the formulation of a comprehensive pollution control plan. This comprehensive plan is to take into account other factors in addition to those of salinity and radioactivity now being considered.

As you can see, very specific projects and approaches to the problem are now coming up, and I think this has been part of the contribution of the conference where we are able to delineate aspects of the pollution problems in abatement and very, very carefully attack them both on a priority basis and integrated basis, systematically, and see if we can get all the pieces to fall into a pattern.

Now a word about the procedure governing the conference. Mr. Al Zimmer is making a record of the conference.

We will make copies of the summary of the conference available to the States for distribution, and also copies of the verbatim transcript will be made available. Both can be obtained through your State water pollution control agencies.

We will call upon interested Federal Departments and the various State agencies for statements. The conferees will be permitted to ask questions and make comments and at the conclusion of the conferees' comments or questions I may ask a question or two. At the conclusion of these, we will have a general discussion and then attempt a summary.

For the benefit of the record, we would like to have any persons making a statement, other than the conferees, come up to the lectern and identify himself, both as to name and organization, before he speaks. This is for purposes of the record.

Opening Statement - Mr. Stein

I would like to call your attention again to the fact that the transcript, as usual, will be printed in black and white. Therefore, if any participant has an exhibit that has color in it, the exhibit will appear in black and white. It will be appreciated if remarks are not directed to "the red portions of the chart" or "the blue portions of the chart," since, when these appear in the transcript, it is not very intelligible.

We would appreciate your cooperation in that respect.

At this point we would like to call on Mr. Lester Klashman, for the Department of Health, Education, and Welfare.

Mr. Klashman.

STATEMENT OF LESTER M. KLASHMAN, CONFEREE AND REGIONAL PROGRAM DIRECTOR FOR WATER SUPPLY AND POLLUTION CONTROL, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, REGION VIII, DENVER, COLORADO

MR. KLASHMAN: Thank you, Mr. Stein.

I shall limit my remarks primarily to introduction.

First, I would like to introduce Dr. Roy Cleere, Executive Director of the Colorado Department of Public Health. We are very happy that he is with us.

Dr. Cleere, did you have anyone else you would like to introduce?

DR. CLEERE: I would like to introduce Mr. P. W. Jacoe, Chief, Radiological Health Services, Colorado Department of Public Health.

MR. KLASHMAN: The representatives of the Department of Health, Education, and Welfare, and other Federal agencies represented, are Mr. John G. Detmer, Regional Attorney, Region VIII, of the Department of Health, Education, and Welfare.

Mr. Kaarlo W. Nasi, Associate Regional Health Director for Environmental Health, Public Health Service,

Reproduced from best available copy.

L. W. Klashman

Region VIII, Denver.

The Colorado River Basin includes portions of three Public Health Service, Department of Health, Education, and Welfare, regions.

I am with Region VIII in Denver.

Mr. Paul Eastman is Regional Program Director for Water Supply and Pollution Control, Region IX, San Francisco, California. His region includes California, Nevada, and Arizona.

Mr. Jerome Svore is Regional Program Director for Water Supply and Pollution Control, Region VII, Dallas, Texas. His region includes New Mexico.

The Department of the Interior is represented by William T. Davoren, Regional Coordinator, Pacific Southwest Region, United States Department of the Interior, with headquarters at Salt Lake City.

Mr. Maurice N. Langley, Acting Chief, Division of Irrigation and Land Use, United States Bureau of Reclamation, Department of the Interior, Washington, D. C.

Mr. A. B. West, Regional Director, Bureau of Reclamation, Region III, Boulder City, Nevada.

Mr. C. C. McDonald and Mr. Burdge Ireland of the Yuma Project Office of the United States Geological Survey, I believe are here.

L. W. Klashman

Thank you, gentlemen.

Mr. Charles A. Richey, National Park Service Director at Boulder City.

With the Atomic Energy Commission, Mr. Don F. Harmon, Radiation Safety Specialist, U. S. Atomic Energy Commission, Washington, D. C., is representing Mr. Nussbaumer of the Division of Materials Licensing.

Mr. Clyde Stewart, Economic Research Service, Logan, Utah, represents the Department of Agriculture.

The United States Army Engineers Los Angeles field office is represented by Mr. Seldon F. Cramer and Mr. John R. Stipp.

Mr. Kirk M. Sandals, River Basin Representative, Pacific Southwest, Soil Conservation Service of the Department of the Agriculture, sent his regrets that he would be unable to attend.

Mr. Charles Sponagle, who has been the Project Director for the Colorado River Basin Water Quality Control Project since its beginning in 1960, is being transferred, at his request, to a challening and highly technical position at the Public Health Service Sanitary Engineering Center in Cincinnati, Ohio.

Thank you, Charlie.

Mr. John M. Rademacher has taken over from him as Project Director. Mr. Rademacher has been our Chief of the Enforcement Program in our Region V office, Chicago, and in addition has been Project Director of the Twin Cities Upper Mississippi River Project.

We welcome Mr. Rademacher to our region.

Mr. Rademacher will now make his presentation and introduce our other speakers from the project.

STATEMENT OF JOHN M. RADEMACHER, PROJECT
DIRECTOR, COLORADO RIVER BASIN WATER
QUALITY CONTROL PROJECT

MR. RADEMACHER: Thank you, Mr. Klashman.

Chairman Stein, distinguished conferees, ladies and gentlemen:

The report today to this conference will be concerned with the implementation by the project of the program agreed to at the last conference session. As indicated in the agenda, the four principal aspects of the project program will be individually discussed. These are the overall technical design for the salinity study, a progress report of the project's salinity studies, the economic studies related to the salinity problem, and the radiological surveillance program.

The technical design for the salinity study by the Colorado River Basin Water Quality Control Project was developed by Mr. Charles Sponagle. In view of his close association with the project, he shall be available to answer any pertinent questions on this program. The progress report on project salinity activities will be presented by Mr. Joseph Fitzpatrick, Deputy Project Director. A review of the salient features of the economic aspects of this study will be made by Dr. Nathaniel Wollman, Professor of Economics, University of New Mexico. Finally, Dr. Ernest C. Tsivoglou, In Charge, Physical and Engineering Sciences, Technical Advisory and Investigations Section, from the Sanitary Engineering Center in Cincinnati, will discuss the progress of the radiological surveillance program since the last conference.

It was agreed at the fourth session of the conference that the project would concentrate on the study of pollution due to salinity. A review of the general objectives as spelled out by the conferees will serve to emphasize the bases for the technical design of the project's salinity studies. These are:

I. Assess the nature and magnitude of the salinity buildup in the main stem of the Colorado River and its tributaries.

II. Investigate and evaluate feasible methods of controlling and minimizing salinity concentrations and loads in the river.

III. Evaluate the net basin-wide economic benefits associated with various degrees of salinity control.

To accomplish these objectives a six-step action program has been developed involving a coordinated effort by the various elements of the project and its economic contractor. Simply stated, these include:

1). Determination of existing salinity conditions.

2). Estimation of future growth and development in the Basin.

3). Evaluation of damages to water users associated with various salinity concentrations.

4). Investigation of feasible salinity control methods.

5). Estimation of water quality with control methods.

6). Determination of the economic balance between costs and benefits of salinity control.

These steps represent an orderly and systematic approach to the study and will be applied to the individual sub-basins of the Colorado River, and to the Basin in its entirety. Of course, the program plan also takes cognizance of those significant areas outside of the Basin which utilize the Colorado River water. These areas will be included in the study program.

A brief resume of each of the component steps should serve to familiarize the conference with this technical design.

Step one is primarily a field operation to determine the existing salinity conditions. The purpose is to explain the observed river salinity concentrations and loads in terms of the specific salinity sources and other factors responsible for causing river salinity loadings and concentrations to change.

An analysis of salinity conditions as indicated by existing data will be made. Considerable information already exists with respect to salinity concentrations and loadings at various points along the main stem and tributaries of the Colorado River. Maximum utilization of this data will be made in order to eliminate duplication of effort by the project. An analysis of these data with respect to changing salinity conditions in relation to time and distance (that is, going downstream) is a prerequisite to the design of the river sampling programs, as well as other aspects of the investigations. In this connection the project is fortunate in having the cooperation of other Federal agencies, State and local agencies, as well as various private organizations.

Field observations of present river salinity concentrations and loadings are a major operation of the field station. The service arm of the project, the Salt Lake City Laboratory, will analyze the samples collected from the river sampling network to determine salinity conditions along the main stem and tributaries. Existing stations operated by other Federal agencies and private organizations will be utilized to the fullest extent, and data at intermediate stations will be developed as required. Existing flow gaging and precipitation records will also be obtained and correlated with the salinity data.

All existing salinity load sources will be evaluated. Sampling and subsequent analysis for TDS components, conductivity measurements, and flow gaging will be performed on these sources to an extent dependent upon the type and relative importance of the individual source. Included would be natural sources, municipal and industrial sources, and irrigation return flows.

The various influences which contribute to salinity concentration will also be evaluated. These influences include surface evaporation, consumptive losses of water, transbasin diversions, and evapotranspiration losses. A substantial amount of information on these factors is already available from other Federal and State agencies.

As the information is collected by these various activities in this step, the data as developed will be used to picture the present conditions in the Basin with respect to salinity loadings and concentration in the main stem of the Colorado River and its tributaries. A program of this type will involve balancing the salt loads existing in the surface waters proceeding downstream and explaining the changes in salt concentrations in terms of addition or removal of salts and the losses of water to the system.

These data will also be used to identify those points in the stream where significant increases in salinity loadings and/or concentrations are occurring and to identify the specific sources responsible for such increases. Further, the relative significance will be determined for each individual source contributing to the increased salinity loadings and/or concentrations observed in the stream.

One final relationship to be determined from these data in this step is the significance of each type of source contributing to the increased salinity loadings and/or concentrations observed in the stream. These types would be classified as municipal, industrial, agricultural, natural, or other.

Step two considers the future growth and development in the Colorado River Basin. An estimate will be made for 1965, 1980 and 2010 of the magnitude and pattern of growth and development of the population, industry, agriculture, recreation, etc., in the Basin. An important factor which will be considered is the possible future construction of additional water resource development structures. Predictions based upon these patterns of anticipated growth and available water will be made for future salinity loads and concentrations as well as estimates of possible salinity damages associated with these changes.

The predictions of future growth and development are being carried out under the contract with the University of New Mexico and a memorandum of agreement with the U. S. Department of Agriculture. Anticipated water resource developments and their effects on river hydrology will be obtained from other Federal agencies and will be incorporated into the predictions of economic growth and development. Predictions of future salinity concentrations and loads and estimates of associated salinity damages, will be developed.

Step three is directly concerned with the evaluation of damages to water uses associated with various salinity concentrations. The specific purpose of this salinity damage assessment activity is to determine the types of damage or impairment associated with each legitimate water use, and to evaluate the degree of damage associated with existing and future estimated salinity levels. This degree of damage involves not only such obvious items as additional costs of water treatment to the user, but also such secondary effects as his increased water quality needs, and costs to the downstream user associated with resulting further degradation of quality.

There are many types of possible damages to water users which result from increasing concentrations of TDS in the waters used. These damages accrue to municipal, industrial and agricultural users of water.

The present damages may be considered as the fraction of the present water cost that would not have occurred if salinity concentrations had not reached present levels. Decreased water costs would result if present salinity concentrations were to be reduced, and the difference between the costs of reducing instream salinity and the damages would represent a net benefit to the water user.

Future damages may be considered as that fraction of future water cost which could be prevented from occurring if salinity concentrations were to remain at present levels. The savings in cost of water that could result if present salinity concentrations could be maintained, and the difference between the costs of maintaining these concentrations under future conditions and the increases in damages will represent a net benefit to the water user.

Step four involves the investigation and evaluation of feasible salinity control measures which will reduce or minimize salinity loadings and concentrations in the river system. This will include estimates of the costs associated with such control measures in order to compare costs of salinity reduction with benefits to be expected from improving water quality.

In step five the improvements in present and future water quality with feasible control methods in operation will be determined. These improvements can be evaluated only in the immediate geographical area under study. For example, the project is beginning these investigations in the lower main stem sub-basin. As the feasibility of control methods for sources in this sub-basin is determined, the improvements in water quality in this part of the basin with these control methods in operation can be estimated. However, the further improvements in water quality that may be possible in the lower main stem sub-basin due to institution of feasible control measures in the upstream sub-basins (such as, for example, the Green River Sub-Basin) cannot be determined until similar investigations are completed in that basin. This example demonstrates the interrelationships among the various sub-basins and, consequently, the limitations imposed on arriving at a complete evaluation of attainable improvements in water quality.

Step six involves the comparison of the costs of obtaining reduced instream salinity concentrations with the associated reduced costs (i.e., benefits) to water users. The result of this comparison is applied to the gross regional product as developed by the economic contractors in order to determine the maximum net economic benefit associated with improvements in stream salinity conditions. This analysis will be made both for present conditions and future expected conditions, including consideration of alternative development patterns.

From the foregoing, a broad outline of the program now being implemented by the Colorado River Basin Water Quality Control Project has been delineated. Recognize that several of these steps will be and are under way concurrently for various sections of the basin. These steps comprise the framework upon which the project will build its recommendations to the conferees. All data collected and summarized by the project staff will be made available to the respective conferees on a regular basis.

That ends my statement.

MR. STEIN: Thank you, Mr. Rademacher.

Are there any comments or questions?

(No response.)

MR. STEIN: Thank you very much.

MR. BONDERSON: Mr. Chairman.

MR. STEIN: Yes, Mr. Bonderson.

MR. BONDERSON: I had hoped we could have a little discussion here.

MR. STEIN: Yes, sir.

MR. BONDERSON: You are embarking on a very ambitious program here, and, to my somewhat limited knowledge, possibly, this is a pioneering effort as it relates particularly to the salinity study and the approach that you are taking.

There are a couple of questions I would like to ask about this.

One of these goes back to last year's conference at which you, in your summary, stated:

> "The project staff will develop for submission to the Technical Committee and hopefully for submission to the conferees at their next meeting the principles or policies which will be used by the project as a guide in the formulation of the comprehensive pollution control plan."

I was wondering what had been done, or what your thinking is on the subject, at this time. I think it is quite pertinent.

MR. STEIN: Yes, it is.

I mentioned that, you may recall, Mr. Bonderson, in my opening remarks as one of the charges that the conferees last year gave to the project managers.

Do you care to answer that, Mr. Rademacher, or can someone else do it?

MR. RADEMACHER: Well, I think that Mr. Sponagle, the developer of the technical design, can probably give me some assistance at this particular point in time.

Charlie?

STATEMENT OF CHARLES SPONAGLE, SANITARY
ENGINEER, UNITED STATES PUBLIC HEALTH
SERVICE, DENVER FEDERAL CENTER, DENVER,
COLORADO

MR. SPONAGLE: Since the last conference, Mr. Bonderson, we have been concentrating primarily on the development of a salinity study.

Consequently, we have not completed the basis of the principles of the comprehensive study to date. However, we have had this in mind throughout our efforts the last year. Of course, other pollutants will be considered in the total project effort.

The development of the set of principles for a comprehensive type of study will be continued in the future. However, we have not completed it at this time.

MR. STEIN: Yes, Mr. Marx?

MR. MARX: I was just wondering about the possibility -- I know that a pesticide study was started, but I haven't heard anything about it recently.

Has that been abandoned for any reason that you know of? You know, we have had a lot of publicity on this recent fish kill in the Lower Mississippi, and there is a lot of interest in this.

MR. STEIN: We now have two questions. I will take your question, Mr. Marx, but as to the first time, I do think Mr. Bonderson has a point. The conferees may want to consider this for the conclusions.

It seems to me that if we are going ahead with any particular aspects of the study, at least we should see, however dimly we can see it, the total study comprising the point that Mr. Bonderson brought up, and we should have a set of principles developed rather soon.

I don't know that it would even be advisable -- and I will throw this thought out to the conferees -- to let another year go by and wait and see if this is going to come up. This may be one of the priority items we should charge the conferees with, and as soon as a draft is developed we should get this to the conferees and perhaps hold a technical session to consider it.

However, I do think that this charge of the conferees last year was entered into in good faith, and I think it should be accomplished or we should try to accomplish it as soon as possible.

MR. RADEMACHER: I think, Mr. Stein, that you can be assured that we will have these points developed within the near future -- I would say within two to three months.

MR. STEIN: The conferees should consider that. Now, on the next point, Mr. Marx --

MR. BONDERSON: Let's back up here, if we could, Murray?

MR. STEIN: Yes.

MR. BONDERSON: I would concur in your giving some priority to this item, as it would appear to me that you have already developed possibly the principle, and from going over the material that you have sent and your presentation here, it seems to me that you have already adopted as your principle economic balance.

If this is the case, I think we should clearly recognize this. If there are other factors, then this should also be brought to our attention at a very early date.

MR. STEIN: Again, let me ask the conferees if this is the judgment they made on principle. I did not understand it as such, Mr. Bonderson, really. I do think that the economic tool is one tool and one aspect and one way of getting at the truth, but there are obvious other tools in our society and our approaches.

I think the economic analyses they are going to have here are probably considered a very probing and useful tool, and perhaps a critical one, but I don't think just by adopting that, that other criteria or approaches are necessarily negated or are not to be used at all.

I certainly would not, at least in my mind, arrive at that conclusion without all the conferees specifically agreeing on what the criteria should be.

MR. BONDERSON: I would agree with you entirely that there are other factors, and I think those other factors should be clearly recognized.

MR. STEIN: Right.

MR. BONDERSON: And they are not at this time.

MR. STEIN: Well, I think this is the point, but, as I understand from the record again, I don't think that there is any purpose in getting purely economic criteria in by the back door and not getting the other criteria in.

That is why I think the charge of the conferees of last year of developing these criteria should be met and a draft of proposals should be gotten to the conferees as soon as we can get them.

By the end of the conference, we can have discussion on that and see if the conferees will agree on it.

Are we set on that?

MR. BONDERSON: All right.

MR. STEIN: As to the pesticide problem, that is a little more complicated.

What has happened here -- and this may be the judgment that I and some of the others were responsible for -- is that our initial work here indicated that pesticides probably were a minimal problem, if a problem at all, and no damages could be assessed with any degree of definitude, nor was there any indication in the basin that pesticides were causing significant actual damages or were significantly a potential threat.

Therefore, with a view to budgetary considerations, and because the project is so vast and complex, the determination was made to give these other items priority and handle the pesticide problem from our laboratory at Cincinnati, rather than having a resident group here.

By the way, subsequent developments have indicated that this is not such a bad idea. I will come to that in a moment.

Since that time, as you probably know, the scientists representing the Public Health Service, have, to their minds, established that at least one pesticide, Endrin, was responsible for extensive fish kills in the Lower Mississippi River during 1963 and 1964.

I might say that this conclusion is not accepted by some people. I am not sure that the manufacturing chemists would agree with this. I am not sure that it is accepted by other agencies concerned of the Federal

Government, such as the Department of Agriculture. I think the Department of the Interior is pretty much in accord with the findings. However, there is a lot of controversy about it.

The significant point was, Mr. Marx, that concentrations of this pesticide were found in parts per trillion in the Lower Mississippi River, where the stream flows are between 100,000 and 500,000 cubic feet per second.

That will give you the notion of the volume of water and the dilution.

MR. MARX: This is the very thing I wanted to get cleared up, Murray.

MR. STEIN: Yes.

Now, it would seem that if the kind of techniques that we would have to get to deal with these pesticides and the kind of scientific personnel, at least initially, where the delicacy of the measurements is such and the newness of the techniques is such, we just have to build up the biologists and the chemists and the engineers we have in Cincinnati.

Here we are faced with another really difficult budgetary problem. The problem is that we do have a going case in the Lower Mississippi. We are going to have a major application season of Endrin starting there shortly. Presumably, we are going to have to make a rather determined effort to monitor that.

The question we have here is whether the same pesticide is being used in any quantity, and, if it is not, whether there are other pesticides which deserve this kind of careful attention.

I don't think we have any magic answers or any definitive answers related to the effects of persistence of other pesticides other than Endrin in low quantities.

The conferees again may wish to consider whether we should get a reevaluation, if it warrants it, of the pesticide problem in this area, and with the recognition that this has set off a nationwide reaction in areas all over the country, asking for our limited resources to evaluate their pesticide problems, whether we can put the resources in.

Mr. White?

MR. WHITE: Mr. Stein, this question was discussed at the Colorado River meeting. Very much the same answer was given, but you see a cropping up, and in the last six months there has been a whole new complexion to this pesticide problem.

We are being asked now by fish and game people and others to get into it. We are in it, whether we like it or not. It is serious, and I would like to ask at least to have some consideration or check with the various States

-- I know two of them who are neighbors of mine, and they are having real problems with this pesticide. It is one of the hottest programs I have at this minute, and I think it is worth reconsidering and looking at.

MR. STEIN: We will.

Now, let me indicate, as I understand the program, and I will let the technical people check me on this, this is not too expensive a program to get into operation, if you agree with our methodology or the methodology that is being developed.

From what I understand, it takes a $10,000 machine. They are using the gas chromatography method. Or it may take a couple of machines, and several persistent biologists.

Our biologists think they have had a tremendous breakthrough and a significant discovery. As with all discoveries of this kind, once you come up with the answer, if you accept the method, the method is not too expensive and it can be mastered.

As I again understand it, the real problem here is getting these machines to work so you can get a reasonably reliable reading. This may require our people coming out, or your sending someone in, to Cincinnati.

According to our people, they seem to have a method of getting the machines to work and coming up with valid and reliable results time after time. Other people have reported they get a bunch of blips and artifacts, and they can't tell what is going on.

I do not doubt that our people have arrived at a valid technique, and I also believe that this is not the kind of a knowledge that can't be imparted to someone else. If, for example, this cannot be explained to the State people or we can't put the people in the field, then maybe the technique is not so good.

MR. WHITE: Murray, the reason I mentioned this is you are in it whether you like it or not.

MR. STEIN: That's right.

MR. BONDERSON: Mr. Chairman, I would like to comment on this general subject area briefly.

MR. STEIN: Yes.

MR. BONDERSON: I don't want to minimize the importance of this problem. It is of tremendous concern to us in California, and, in fact, at the present time we are having about two to three fish kills a week from pesticides.

However, your comments would tend to indicate that this isn't too complex a technical problem. Well, I think this is quite to the contrary. This is not at all a simple problem. Just the physical sampling is a very difficult thing, that you can't just grab a bucket of water and analyze it. It involves dissolveds, it involves suspended materials, and it involves the sediments. You have to look at the total water stream and not just a simple going out and grabbing a bucket.

If you are going to approach the pesticide problems, the project, I am sure, would have to be budgeted to a significant extent. This is not some little side issue that you could take care of.

MR. STEIN: No. I think we recognize that.

I am not saying that the technique is not a most delicate one to perform. I think we should make this clear.

This is the same, it seems to me, as the techniques developed in the radiation program. These are very, very difficult techniques involving measuring of small amounts of radioactive material that have been developed. I was merely speaking of this from the point of view of an administrator.

From the point of view of an administrator, as we see our technique in the program now, this is something that is within manageable proportions, and the technique could be fairly well understood. Once the methods are established, we can pull people out.

The problem in this that I think we have to recognize is that when we deal with radiation, for example, or when we deal with oxygen or soil, once you get your technique, however simple or complicated it may be, and once you get your results, all reasonable people in the field, whether they work for States, localities, Federal Government, industry, or what have you, generally agree on the results.

I am not sure that with the present methodology we have employed in examining for pesticides and the effects of pesticides on aquatic life, we are getting that kind of unanimity of agreement, where, once the results come forward, everyone agrees to them.

What I am suggesting to the conferees is that we might get a consensus, or maybe the conferees should go over this carefully. It would seem that the investment of large sums of money in an approved technique that everyone is going to agree to is one thing; the investment of those sums of money in a technique where results may come up and be hotly disputed is something which needs again careful consideration.

This is one of the problems I think we definitely have to face in this.

MR. MARX: The reason I brought this up, Murray, is that I was just wondering what was going on up in the upper basin in this relation. We in the lower basin are at the receiving end of the deal.

MR. STEIN: If I understand you right, and we will go into this again, I think as Mr. White probably has said, this is something like the various problems we have.

When there are salts or detergents, we have this problem, whether we like it or not. I think the conferees possibly should come up with a recommendation to see just what we have to do to get into this on a stronger basis than we have been in the past.

Are there any other comments or questions of Mr. Rademacher?

MR. BONDERSON: Yes.

MR. STEIN: Mr. Bonderson.

MR. BONDERSON: I have one other question, if no one else has any.

Your project design is most impressive. As I said before this is, I believe, a pioneering effort.

The only observation I have on this, and I would like your comments on this, is that it appears that this is a very ambitious program, and you have no comments relative to what the scheduling or the time involved in completing such an ambitious program might be.

I would like to have your comments on that general subject area.

MR. RADEMACHER: I am glad you asked that question, because it is one that I think everyone looks forward to.

The actual schedule for completing various segments of this ambitious program will be discussed specifically by Mr. Fitzpatrick in his discussion of the progress.

We would hope that the progress will be such in the project, depending upon funds and availability of information, that we would have the project in such a shape that we would have the final report sometime toward the end of the fiscal year 1966, in line with the schedule.

MR. BONDERSON: You mean the work would be completed entirely?

MR. RADEMACHER: We would hope so -- yes -- on this particular phase.

MR. ROZICH: That is what, the salinity and the economic?

MR. RADEMACHER: The salinity and the economic study.

MR. STEIN: That is two and a half years.

MR. BONDERSON: That would be in July of 1967?

MR. RADEMACHER: Right. I believe this is in line with our thinking.

MR. STEIN: Does that answer your question?

MR. BONDERSON: It is pretty specific.

MR. STEIN: It is specific all right.

MR. RADEMACHER: This date, of course, depends in large part upon the availability of funds and people during the course of the project.

MR. STEIN: Are there any other comments or questions?

(No response.)

MR. STEIN: If not, thank you very much, Mr. Rademacher.

MR. RADEMACHER: I think I will carry on from this point, Mr. Stein.

MR. STEIN: Yes.

MR. RADEMACHER: Before I get into Mr. Fitzpatrick's discussion, I would like to introduce Mr. Frank De Martini, the Chief of the Technical Advisory Investigations Section at the Sanitary Engineering Center in Cincinnati. Mr. De Martini.

Also, Mr. Frank Rainwater from the Technical Services Branch in Washington, D. C.

Since a great many of you here will be concerned with the day-to-day operations and investigations of the Colorado River Basin Project, as well as the conferees, I would like to introduce the various individuals in charge of the important segments of the project.

Starting with the Chief of the Phoenix Field Station, Mr. Marshall Rainey, in back of the room. You can look at him. You will be seeing a lot of him.

Most of you know the Director of the Salt Lake City Laboratory, Mr. Edward Rushing.

In Denver, we have two important sections. The first is the Salinity Damage Assessment Section. The Chief of this Section is Mr. Phillip Coffey, in back of the room.

Equally important is the Salinity Control Section. Its Chief, Mr. George Mumma, just came on duty within the last month or so.

I don't want to minimize the activities of the Radiological Surveillance Program, and I would like to introduce the Chief of that Section, Mr. Donald Wruble.

You have seen all these men. You will see more of them in the coming months.

At this point and time, I would like to introduce Mr. Joseph Fitzpatrick, Deputy Project Director for the Colorado River Basin Project, who will give a progress report of the activities of the project during the past year.

Mr. Fitzpatrick.

STATEMENT OF JOSEPH W. FITZPATRICK,
DEPUTY PROJECT DIRECTOR, COLORADO
RIVER BASIN WATER QUALITY CONTROL
PROJECT

MR. FITZPATRICK: Thank you, Mr. Rademacher.

Mr. Chairman, conferees, ladies and gentlemen:

I have made a copy of my statement available to the reporter with attachments that are black and white.

The project established a field station at Phoenix, Arizona, in August of 1963 to assess the nature and magnitude of salinity problems in the lower three sub-basins of the Colorado River. This station is reponsible for collecting and analyzing data on water quality, stream flows, and salt loads, as well as preparing interpretive reports identifying and characterizing sources of significant saline pollution. In carrying out these activities, the station makes maximum utilization of existing long-term salinity and streamflow records to: (1) determine and evaluate the pattern of salinity increase or decrease in relation to time and distance; (2) determine key points where additional salinity or stream flow data are needed; and (3) establish a statistical base for the project's water quality sampling program. The data and reports developed by the field station will be utilized by the Salinity Damage Assessment and Salinity Control Sections in their studies of damages to water users associated with various salinity concentrations and the feasibility of certain salinity control measures.

Representatives are contacting appropriate personnel in field offices of interested Federal, State and local government agencies, as well as other organizations to inform them of the purpose and extent of investigations to be undertaken, to determine the kinds of information they might be able to provide, to solicit their cooperation, and to coordinate field activities in order to avoid duplication of effort. Various agencies, including the U. S. Geological Survey, Bureau of Indian Affairs, Bureau of Reclamation, Agricultural Research Service, International Boundary and Water Commission, Metropolitan Water District of Southern California, and local irrigation districts, are cooperating in making historical and current data on water quality and streamflows available.

An important aspect of the field station's study of existing salinity conditions in the Colorado River and its tributaries is the statistical analysis of historical data on water quality and streamflows. Personnel at the station have been making a statistical analysis of previous records of water quality for the Colorado River between Lee's Ferry and Yuma. During the past forty years, a vast amount of water quality data has been collected at a number of river, tributary and diversion stations within this portion of the Colorado River Basin by various agencies.

From the long-term records, some 121 station-years of quality data were selected for the statistical analysis. These data are being analyzed by standard statistical methods to determine the pattern of salinity increases or decreases in relation to time and distance. The time pattern is being analyzed in relation to the history of water uses and other developments, such as the impoundment of major reservoirs, establishment of irrigation projects and exportation of water from the basin. The distance pattern is being analyzed with the view of identifying reaches of the river where significant salinity build-up occurs.

It is expected that the statistical analysis for the Colorado River between Lee's Ferry and Yuma will be completed by the end of the current fiscal year. It is anticipated that this analysis will provide statistical bases for:

(1) Evaluating the water quality measurements made by the project;

(2) identifying historical changes in water quality;

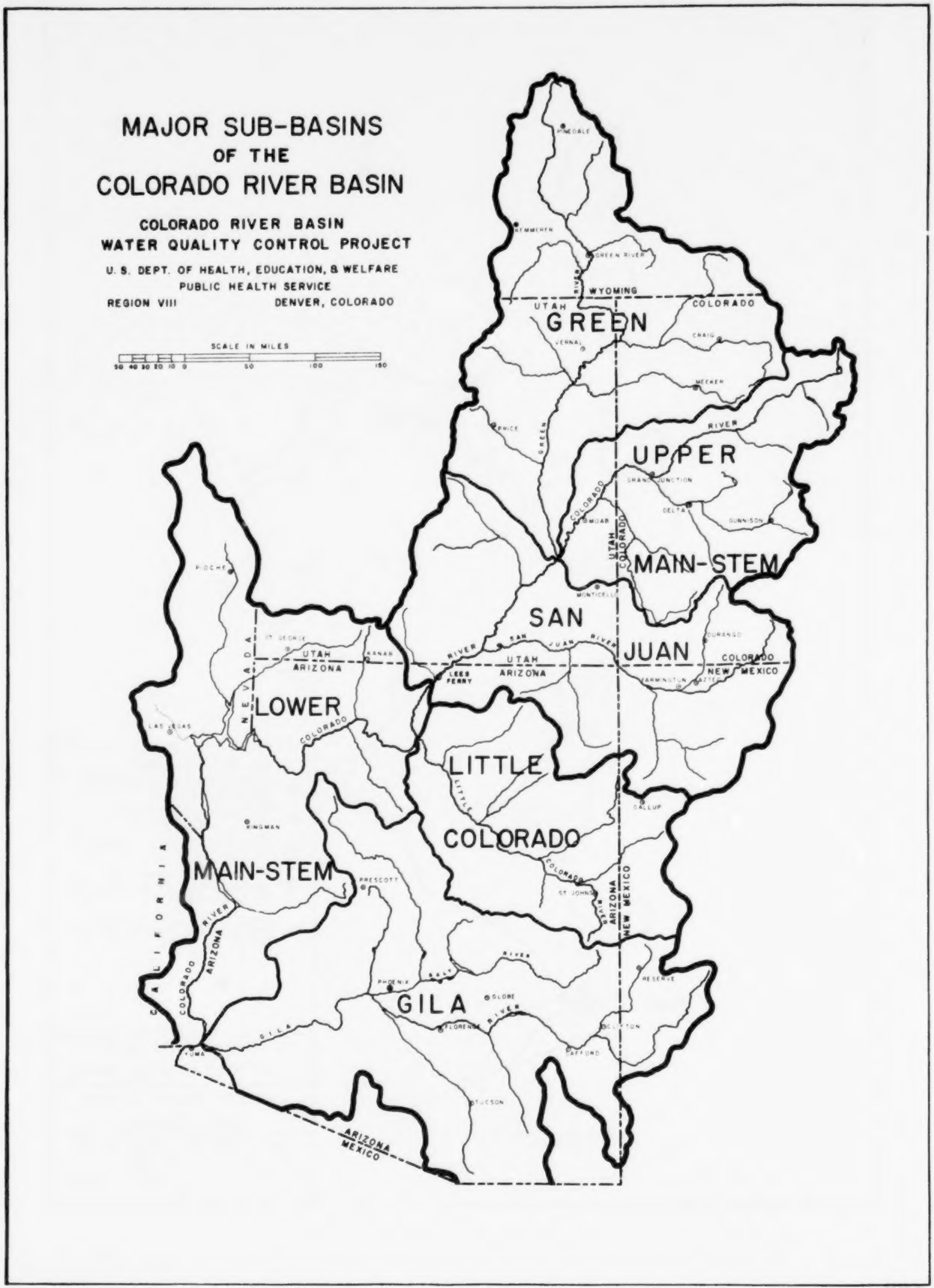
(3) forming logical conclusions regarding the effect of water uses and other developments on water quality in the river; and

(4) identifying major salinity sources.

A similar type of statistical analysis will be completed for the Gila and Little Colorado sub-basins in July of 1964, and for the San Juan, Green, and upper main stem sub-basins during the latter part of fiscal year 1965.

In July of 1963, a tentative salinity sampling network was formulated for the lower main stem sub-basin. During the summer and early fall, field station staff members made a field reconnaissance of the sub-basin, at which time, each proposed sampling point was evaluated and definite locations were selected for sampling stations. The sampling network includes 12 stations on the Colorado River between Lee's Ferry and the Mexican border, and 15 stations on tributary streams. Of the total of 27 stations, 10 are being sampled routinely by other agencies. A map will be provided for the record.

We have two identical maps on the board and blackboard here, which you may examine sometime during the day.



MAJOR SUB-BASINS OF THE COLORADO RIVER BASIN

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT
U. S. DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

SCALE IN MILES
50 40 30 20 10 0 50 100 150
GREEN
UPPER
MAIN-STEM
SAN
JUAN
LOWER
LITTLE
COLORADO
MAIN-STEM
GILA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NEVADA
CALIFORNIA
ARIZONA
MEXICO
PINEDALE
KEMMERER
GREEN RIVER
RIVER
VERNAL
CRAIG
MEEKER
PRICE
GREEN
RIVER
GRAND JUNCTION
DELTA
GUNNISON
COLORADO
MOAB
MONTICELLO
DURANGO
FARMINGTON
AZTEC
RIVER
SAN
JUAN
RIVER
LEES FERRY
PIOCHE
ST. GEORGE
KANAB
LAS VEGAS
COLORADO
LITTLE
GALLUP
COLORADO
ST. JOHNS
RIVER
KINGMAN
PRESCOTT
RIVER
COLORADO
PHOENIX
SALT
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GLOBE
RESERVE
GILA
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RIVER
CLIFTON
SAFFORD
YUMA
TUCSON

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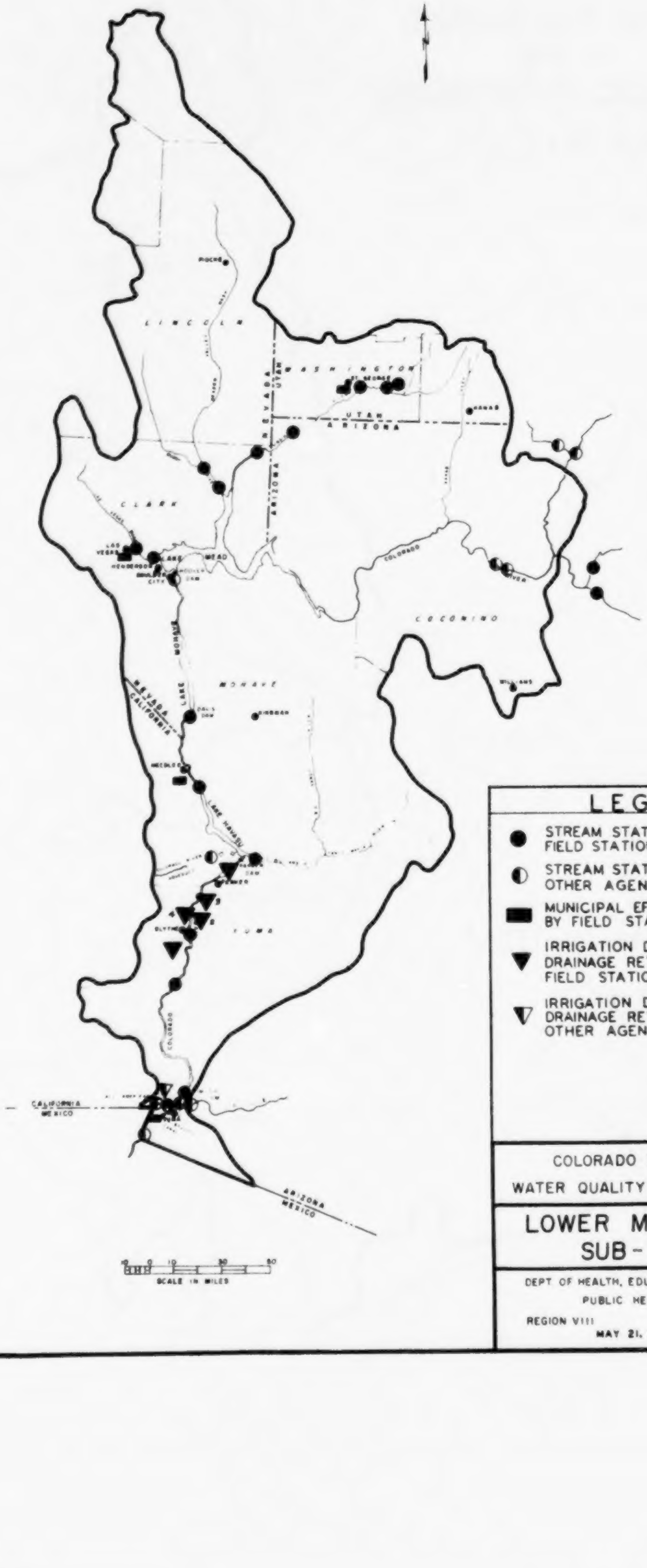
N
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NEVADA
CLARK
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HENDERSON
BOULDER CITY
LAKE MEAD
COLORADO
RIVER
COCONINO
WILLIAMS
MOHAVE
KINGMAN
LAKE MOHAVE
NEVADA
CALIFORNIA
NEEDLES
LAKE HAVASU
PARKER DAM
BLYTHE
YUMA
COLORADO
CALIFORNIA
MEXICO
ARIZONA
MEXICO
10 0 10 30 50
SCALE IN MILES

LEGEND

● STREAM STATION SAMPLED BY FIELD STATION

◐ STREAM STATION SAMPLED BY OTHER AGENCIES

▬ MUNICIPAL EFFLUENT SAMPLED BY FIELD STATION

▼ IRRIGATION DIVERSION OR DRAINAGE RETURN SAMPLED BY FIELD STATION

▽ IRRIGATION DIVERSION OR DRAINAGE RETURN SAMPLED BY OTHER AGENCIES

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT

LOWER MAIN-STEM SUB-BASIN

DEPT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO
MAY 21, 1964

J. W. Fitzpatrick

Field station personnel began routine sampling at the seven stations located below Hoover Dam in October 1963 and at the ten stations above Hoover Dam and within the Muddy and Virgin River Basins in January 1964. Grab samples are being collected at weekly or two-week intervals, depending upon the accessibility and relative importance of the station. The samples are sent to the project's laboratory in Salt Lake City, Utah, where they are analyzed for chemical composition of dissolved minerals and certain physical properties, such as pH and electrical conductance. When necessary, special tests will be made for iron, manganese, phosphates, and toxic metals.

As laboratory results are received, they are inspected for completeness and compared with previous data. Calculations are made to obtain salt burden or tonnages conveyed by the stream for the sampling periods. Secondary properties, such as sodium adsorption ratios, percent sodium, relationships of specific conductivity to total dissolved solids and constituent ions, are checked and calculated. Various graphical techniques are utilized to evaluate and compare the analytical data.

Streamflow records are being obtained from other agencies for all current sampling locations. Where the need exists, arrangements will be made for the establishment of additional stream gauges. Precipitation records are being received on a routine basis and will be utilized in determining the effect of rainfall on stream regimens and water supply. Times of flow studies will be employed to correlate downstream conditions with intermittent or variable upstream salinity discharges.

Routine sampling will be completed in the lower main stem sub-basin at the end of December 1964. The analysis and evaluation of all water quality data will be finished as soon as possible.

A tentative sampling network to supplement existing data has been developed for the Gila and Little Colorado sub-basins. Field surveys of both sub-basins will be made during the latter part of the current fiscal year in order to select suitable sampling stations. Sampling will be initiated in both sub-basins in July 1964.

A reconnaissance of significant natural spring sources within the lower main stem sub-basin was made during the summer of 1963. The hot mineral springs are often high in boron, lithium, sodium, bicarbonate, chloride, fluoride, and other constituents. Project personnel sampled spring areas below Hoover Dam during September 1963 and the natural springs in the Virgin and Muddy River Basins in February 1964. Evaluation of the net significance of natural salinity sources for the stream regimen within the lower main stem sub-basin will be completed by January 1965. Work in the other two lower sub-basins will commence in July 1964 and be completed in fiscal year 1965.

The municipal effluents of St. George, Utah; Las Vegas, Nevada; Needles, California; and Yuma, Arizona -- the four largest communities discharging to surface water courses in the lower main stem sub-basin -- are being monitored by biweekly conductivity measurements. This activity commenced in January 1963 and will continue through December 1964. Short-term intensive salinity sampling of these municipal effluents and significant industrial sources will be conducted in the summer and again in late autumn of 1964. Beginning in July 1964, similar activities for municipal and industrial effluents will be undertaken within the Gila and Little Colorado sub-basins. Municipal effluents are sometimes high in boron, as well as sodium and chloride.

Activities on the evaluation of salinity sources associated with irrigation in the lower main stem sub-basin were initiated during the summer of 1963. This work included a reconnaissance of irrigated areas, discussions with representatives of irrigation districts, and the establishment of sampling networks in several of the major irrigated areas. Since October, weekly sampling has been carried out at eight locations to determine changes in water quality through the sequence of diversion, irrigation, and surface drainage returns to the river. Other agencies are also sampling in several irrigated areas and arrangements have been made for the station to utilize their data. Flow data are also being provided by other agencies and irrigation districts. In some situations, automatic conductivity recorders will be utilized in evaluating salinity sources associated with irrigation.

Field work on this activity in the lower main stem sub-basin will be completed next December. All data will be analyzed. The location and significance of all major salinity sources associated with irrigation will be documented.

A reconnaissance of irrigated areas in the Gila and Little Colorado sub-basins will be made in June and sampling and other evaluation activities will be initiated about July 1, 1964. Preliminary investigations are also scheduled to begin in the San Juan sub-basin during the latter part of 1964.

Data on evaporation losses occurring within the lower main stem sub-basin has been compiled by staff members. These data indicate that over 96 percent of all such losses are due to evaporation from Lakes Mead, Mohave and Havasu and from principal streams and canals. The total losses from surface evaporation within the lower main stem sub-basin are about 1.4 million acre-feet per year.

Consumptive losses due to municipal and industrial uses will be evaluated in conjunction with the salinity sampling surveys of these sources. This aspect will be accomplished within the lower main stem sub-basin by January 1965 and will be completed for the remainder of the Lower Colorado River Basin by July 1965. Agricultural consumptive use data is being gathered in conjunction with the evaluation of existing salinity sources associated with irrigation and will follow essentially the same time schedule. Both quality and quantity information is currently being studied and analyzed on trans-basin diversions from the lower main stem sub-basin. This activity is scheduled concurrently with the river sampling program.

A short-term intensive water quality study was carried out in cooperation with the USGS in February 1964. The results of this survey will be utilized in evaluating natural chemical precipitation phenomena occurring in reservoirs of the Colorado River from Hoover Dam to the Mexican border.

J. W. Fitzpatrick

Salinity Damage Assessment Section

The activities assigned to the Salinity Damage Assessment Section are to determine the kinds of potential damage or economic losses associated with each beneficial use of water, and to evaluate the actual degree of damage associated with present and future levels of salinity and hardness. Damages involve not only such obvious items as additional costs of water treatment, but also, in some cases, a requirement for additional water in agriculture and industry, as well as cost considerations to downstream users resulting from impairment of water quality upstream. Damages will be assessed relative to selected levels of water quality; for example, the increase in costs at the present time, compared with those costs which would have been incurred if it had been possible to maintain the river and its tributaries in a relatively unpolluted state; and the further increase in users' costs which will occur if present quality levels in the river system should rise within the next few decades. The cost to be estimated in this manner will be a measure of the benefits which might be attained by salinity abatement or control, and hence will determine how much can economically be invested to abate pollution of water by dissolved mineral constituents. The data and reports developed by the Salinity Damage Assessment Section will be used by the salinity control investigations group as a guide in determining economic feasibility of salinity control measures.

Many types of damage can be attributed to hard and saline water supplies in domestic, industrial and agricultural use. Wildlife and recreational uses of water may also be affected by extreme rises in salinity. The following list shows some of the kinds of damage to water users in municipal, industrial and agricultural supplies which the project expects to investigate or at least to consider.

Municipal Use

(a) The need to develop an alternative source of water supply as salinity increases in the present source. The Public Health Service Drinking Water Standards recommend that municipal water supplies be obtained if possible from sources of 500 mg/l or less total dissolved solids.

(b) Increased consumption of soap and detergents, and formation of scum and curds.

(c) Yellow staining and decreased life of fabrics.

(d) Formation of scale in water heaters and plumbing fixtures generally, reducing their length of service.

(e) Increased corrosion of water lines and fixtures, resulting in shorter life and more frequent replacement. This includes need for corrosion-resistant materials in water treatment plants at increased cost.

(f) Cost of using bottled water.

(g) Cost of water softening (municipal plant or home user).

(h) Damages to ornamental shrubs and other plants.

(i) Possible physiological effects due to the concentrations of certain specific constituents, such as sodium, fluoride and nitrates.

Industrial Use

(a) Formation of scale in cooling water systems, boiler tubes, water heaters, and water supply and distribution systems generally, especially those conveying hot water, with consequent higher service costs and shorter service life.

(b) Carry-over of saline water with the steam from boilers, with resulting lower efficiency of operation.

(c) Weakening of concrete (water containing over 400 ppm of sulfates is unacceptable for use in making concrete which is to be prestressed).

(d) Excessive hardness and mineral ion content render water unsatisfactory for many industrial process uses, including laundering, dyeing, and textile manufacture, brewing, carbonated beverages, candy-making, food processing, and photography. The industrial requirements are in some cases more exacting than the standards for drinking water.

Agriculture (Irrigation of Crops)

(a) The duty of water, i.e., the amount applied per unit area for equivalent results, rises in proportion to salinity of the applied water, owing to the greater amount of poor quality water needed to leach salts out of the soil in the plant root zone. Hence irrigating with water of poor mineral quality is more expensive than with good water. The effect is compounded by:

(1) Greater loss of applied fertilizers leached by the higher amount of water needed.

(2) Higher labor costs caused by the need for more frequent irrigation.

(3) Raised cost of under-drainage of land irrigated with poor quality water, since the system must be designed for greater volumes of flow. In some cases no under-drainage would be necessary with irrigation water of high quality, so that the entire cost of drainage is attributable to poor water.

(b) Saline irrigation waters are harmful to many types of crops, especially those classified as salt-sensitive, such as citrus and deciduous fruits, certain garden vegetables, nursery plants and shrubs, etc. Depending upon the concentration of mineral salts, yield of crops may be reduced or the plants actually destroyed.

(c) Where a fixed amount of water is available to the irrigator, it may be necessary to reduce the crop acreage as salinity increases in the applied water. There is also a decreased possibility for economic development due to the rise in demand for irrigation water as salinity increases, with the result that less water is available for other uses.

Another task which has been assigned to the Salinity Damage Assessment Section is to develop estimates of water requirements in municipal, industrial and agricultural service at stipulated future dates, on the basis of economic and demographic projections to be provided by the contractors for economic studies. The Section will also work closely with the Salinity Control group in analyzing the benefits to be realized by the various proposed measures for abatement of saline pollution, such as the eradication of non-beneficial vegetation, evaporation suppression, reduction of canal seepage losses, et cetera.

The project has been fortunate in obtaining the services as a consultant of Mr. Lloyd V. Wilcox, formerly Assistant Director of the United States Salinity Laboratory at Riverside, California, and a nationally recognized authority in his field. He will help work on the problems of the economics of irrigation water supply.

The project staff is developing an estimate of the additional water which will be needed in the future to maintain tolerable levels of salinity in the soil solution in the Palo Verde Irrigation District of Southern California. Similar calculations are being extended to other major irrigated areas in the lower main stem sub-basin, including the Colorado River Indian Reservation and the subdivisions of the Yuma Project of the United States Bureau of Reclamation. The staff will investigate the relationship of increasing salinity in agricultural water supplies to the amount of water needed for leaching of salts in irrigated lands, the additional cost of under-drainage in areas where land drainage is a problem, the loss of applied fertilizers due to heavy applications of irrigation water, and other factors which appear relevant to the problem.

As many of you know, in 1961 the City of Yuma was compelled to change its source of water supply as a result of a rapid rise in hardness, chlorides and salinity to levels intolerable in a public water supply. This impairment in quality has been attributed to the discharge of saline agricultural drainage into the Gila tributary of the Colorado a few miles upstream from Yuma. Certain expenses were, of course, associated with this change of source. With the assistance of the Arizona Water Company, our project staff is completing a study of these costs, which will include:

1. Construction of the new intake facilities, including pumps, pipeline and appurtenances.

2. The loss involved in abandoning the original Colorado River intake.

3. The differences in the cost of the operation of the old and new facilities, comprising such items as water rights, electric power, labor, water treatment, taxes and depreciation.

The study includes the penalty costs of water softening and of soap and detergent consumption in Yuma due to increasing hardness of the supply. Two comparisons of softening costs will be considered, based on historic changes in quality of the local water supply between 1905 and the present year, 1964, and between 1964 and the water quality levels projected for the year 2000.

Our study of salinity damage is being extended to include effects on industrial water supplies in Clark County, Nevada, which has one of the Southwest's major complexes of chemical and metallurgical industries near Henderson. With the cooperation of the Nevada State Department of Health and Basic Management, Incorporated, and its associated firms, we plan to assess the value of maintaining water quality in these industrial water supplies.

During the fiscal year 1965, salinity damage appraisal will be extended to the sub-basins of the Gila and Little Colorado Rivers, and we shall begin the identification of existent types of salinity and hardness damages in the upper basin of the Colorado. We shall continue to assemble and study data and projections of available water supplies, water requirements and water quality levels in all areas of the Lower Colorado River Basin. We expect to carry out an evaluation of effects of various proposed measures for salinity control on the present and future quality of surface waters in the main stem of the Colorado River below Lees Ferry.

Salinity Control Section

The activities assigned to the Salinity Control Section are to investigate and evaluate technically feasible salinity control measures which will reduce or minimize salinity loadings and concentrations in the river system, and to estimate the costs associated with such control measures. The development of a salinity control program is based upon a complete knowledge of what and where the sources of salinity are, and the effects of concentrating factors.

The Salinity Control Section is dependent not only upon the field station for determining the location and magnitude of the sources, but also upon the Salinity Damage Assessment Section for the determination of the costs associated with the salinity.

The sources of salinity may be divided into two general categories, man-made sources and natural sources. The man-made sources are derived from municipal, industrial and agricultural uses of water. In each of these uses, generally, there is a loss of water from the river system by either beneficial or nonbeneficial consumptive use which tends to aggravate salt concentrations. Also, these uses almost always result in an increased salt load in the stream.

The natural sources of salinity include not only the flows that contribute salt to the stream, such as natural saline springs and salts in runoff, but also the losses from the basin, such as evaporation and transpiration that result in increased salt concentration.

All technically feasible methods of controlling these sources will be considered. The cost of implementing the proposed salinity control measures will be determined. Concurrently, an evaluation will be made of the effects of the proposed control program on instream salinity. These studies will provide a correlation of salinity control costs with resultant instream salinity.

J. W. Fitzpatrick

These relationships (i.e., instream salinity vs. control cost) will be used in conjunction with the results of salinity damage assessment study relating instream salinity to economic benefits. They will be compared and analyzed to determine the instream salinity that can be maintained at costs that will be justified by benefits to the regional economy. Similarly, the lower limit of instream salinity is at the point where control expenditures would be greater than the increase in benefits to the regional economy. This comparison and analysis is frequently referred to as the "economic balance."

Mr. Chairman, that concludes my statement.

MR. STEIN: Thank you, Mr. Fitzpatrick.

Are there any comments or questions?

Mr. White?

MR. WHITE: In this analysis and discussion, there is considerable information on salinity and the components of water itself. However, in the last several weeks there have been some discussions of lowering the levels at Lake Mead.

I notice, on Page 12, an evaluation of the costs as to Yuma. I think it might be appropriate now to ask for some awareness on the part of the project to the losses as to recreation, fish and so forth, resulting from this dropping of the Lake Mead level from 1,123 to 1,080.

I don't know whose toes you are stepping on. I don't know if you have nerve enough to try it, but here is something that is going to affect us right here in the Las Vegas area, and I would like to see you look at it.

MR. STEIN: Thank you, Mr. White.

I don't know that our reputation is such that we need a dare. I think it is abundantly clear that we try or take on almost anything, anyway.

MR. WHITE: I would like you to take it on.

MR. STEIN: Are there any other questions or comments?

Mr. Bonderson?

MR. BONDERSON: Mr. Chairman, on your Salinity Damage Section, it indicates you are going to be doing certain studies as it relates to in-basin activities.

Will this eventually be extended to the out-of-basin service areas, as time progresses?

MR. STEIN: Mr. Fitzpatrick?

MR. FITZPATRICK: Mr. Bonderson, I believe Mr. Sponagle indicated at the last technical meeting held in February of this year and also at the last conference, that other areas would be considered, as funds permitted the scheduling on this activity. That is something I would like to ask Mr. Stein about, whether there has been any decision on resources, and when this might be able to be undertaken.

MR. STEIN: You have just about as much money as we indicated you were going to have.

I think the problem is that it was indicated we are going to have a little help, and I think we are going to have to live with it within our budget.

That is not the question, is it?

MR. BONDERSON: That isn't the answer.

MR. STEIN: No. What do you mean by "out-of-basin"? Do you mean out of the Colorado --

MR. BONDERSON: Well, out of the physical basin, like your lower main stem here does not include the Imperial Valley, but yet it is a service area of the Colorado system.

You have indicated that you are going to evaluate water needs as it relates to quality in the Palo Verde area. Are you going to do likewise in the Imperial area?

MR. STEIN: Do you have a recommendation on that?

MR. BONDERSON: Well, as I have indicated before, I don't see how you can look at just a part of the system and come up with equitable or appropriate answers.

MR. STEIN: No.

MR. BONDERSON: The total system, including the out-of-basin service areas, must also be taken into consideration if this thing is to be truly meaningful.

MR. STEIN: I think if the conferees agree with that, we would have no objections to doing that.

This is aside from the budget question. As a matter of fact, to my mind, this is one of the most important projects we have going, and I am sure that if the conferees think that it is appropriate to examine these areas and make such a recommendation, that will be scheduled and funds will be found, hopefully, and will be forthcoming. I have no reason to believe that they won't.

I fully agree with you, Mr. Bonderson, in principle, that we have to get the complete analysis of all these areas to get an integrated picture of what the program will be for the Colorado River Basin Valley.

MR. ROZICH: Mr. Chairman?

MR. STEIN: Yes.

MR. ROZICH: Along the same line then, would this include Colorado where we have trans-mountain diversion that is going in which will include the Arkansas River Basin, which empties into the Missouri River Basin?

MR. STEIN: No. I think again it is a question of judgment here.

Whether you are going to have complete trans-basin diversions or not is something you can study ad infinitum. I do think that obviously California, particularly Southern California, is in a peculiar situation here.

Here, ten million people are depending upon this river system for their water, and I think the situation is quite different with the effects there than it would be in some of the other areas, where we would happen to have trans-basin diversions.

MR. KLASHMAN: May I say something, Mr. Bonderson?

As we have indicated before, we have no intention of letting the consideration of the lower basin out-of-State diversion go. We definitely plan to bring this into our considerations and our studies.

However, in the upper basin, as Mr. Stein said, the situation is quite different, because it is up at the headwaters, and the effects are a completely different matter. We definitely have under consideration the diversions out of the lower basin.

MR. STEIN: Are there any further comments or discussion?

MR. WILLIAMSON: I think this comment of mine probably goes back to Paul Bonderson's original question, and that is, is the economic balance the only principle we are going to apply in this field, because in the field of municipal water supplies I can see that this might not do justice, to me, anyway. In any of these municipalities -- and I am thinking of some of my municipalities, not necessarily in this basin, but in similar situations, where they have historical water rights that are very good -- at the present time they are using water that isn't drinkable. I mean, this is all that is left in the stream.

When you start evaluating the economics of a large irrigation project against the losses in this small community, why, you are not going to come out with a good ratio of cost, but still these people have legal or moral rights, or something which it looks to me like they are getting the long end of the deal when somebody gives them nothing but undrinkable water.

It is going to be a big expense to them. The answer is, I don't think we make the decision. I think this is probably up to the individual States for water rights, or something in those States.

It is a problem, and it can't be always looked at strictly from economics.

MR. STEIN: Mr. Williamson, I was struck by the same thing by the question and listening to this paper, and I think possibly the conferees again might want to consider as one of the priority items getting this into focus and trying to arrive at these criteria that Mr. Bonderson spoke about.

Mr. Thatcher?

MR. THATCHER: I just wanted to make a brief comment with regard to Mr. White's statement on examining the effect of lowering the level of Lake Mead.

We can't leave Lake Powell out of this, because I am sure that you will find the levels of these two lakes are dependent variables.

MR. STEIN: Off the record.

(Discussion off the record.)

MR. STEIN: Are there any other questions or comments?

MR. BONDERSON: I wonder if we could have a little elaboration here on Page 12?

You indicate that you will begin the identification of existent types of salinity and hardness damages in the upper basin of the Colorado.

Does this indicate that there will be similar types of studies undertaken in the upper basin as are now underway in the lower basin?

MR. FITZPATRICK: Yes, there will be similar types of studies.

MR. BONDERSON: Good.

MR. STEIN: Are there any further questions or comments?

(No response.)

MR. STEIN: If not, I think we will take a recess for a stretch for ten minutes, and we will promptly reconvene.

We expect to have one more presentation which would run about between thirty and forty minutes, and which will get out to lunch somewhere before twelve-thirty.

We stand recessed for ten minutes.

(Whereupon a recess was had.)

MR. STEIN: May we reconvene?

We will next call on Dr. Nathaniel Wollman of the University of New Mexico, who is in charge of our economic study.

The Department and the Service and the project were fortunate enough to be able to secure the services of Dr. Wollman, who has an international reputation in this field, and who will undertake this important aspect of the budget work.

Dr. Wollman.

STATEMENT OF DR. NATHANIEL WOLLMAN,
UNIVERSITY OF NEW MEXICO

DR. WOLLMAN: Thank you, Mr. Stein.

Ladies -- very few of you -- and gentlemen:

What I have to say this morning is my own view, and neither the Public Health Service nor any of its staff have arrived at any official position on any of the matters that I will discuss.

The economic base study is being carried on by the University of New Mexico and the University of Colorado. At the University of New Mexico the work is under the direction of Bernard Udis and Paul Therkildsen and Professor William Miernyk, who is in charge of the work at the

University of Colorado. William Leasure of San Diego State College is doing the population projection. Gilbert Bonem of the University of New Mexico and Jack Chapman of the University of Colorado are responsible for important segments of the study.

When we are ready to submit our final reports, we will include a full list of all of the participants.

The economic study of the Colorado River Basin Water Quality Project fulfills a central role, since, initially at least, economic criteria are expected to give meaning to the concept of "public welfare." My discussion will deal with the model of the study and how the economic and engineering components are to be merged.

The problem to be solved is twofold: (1) What are the interactions between water supply, water use, and the economy of the region; (2) can we say that one pattern of water use is preferred to another? The first question is answered by gathering a considerable amount of engineering and economic data. The answer to the second question provides a clue as to the kind of data we need.

We start by postulating that a water resource policy can have alternative objectives that compete for satisfaction. We further assume that one basis of choice of policy will be the interactions between water resource use and economic magnitudes. An economic measure that fulfills a key role is gross regional product, or GRP. GRP represents the aggregate of economic activity that takes place in the region, after eliminating double or multiple counting, just as gross national product is a corresponding measure for the national economy. Measurement of the national product is a task assigned to the National Income Division of the United States Department of Commerce. Good figures on GNP, by industry sector, go back to 1929; and a number of estimates exist that carry the series back for many more decades. As you may know, there is no agency responsible for computing regional or State product. While we shall base most of our analysis on the behavior of gross product as divided among major industries, we shall also be interested in other economic measurements, employment, per capita income, and capital requirements.

I shall first describe the economic model that we plan to use and then give you a sample of some of the economic data we are collecting. Our objective is to relate economic behavior to the constraints imposed on that behavior by water quantity and quality. We propose to do this by constructing alternative hypothetical economic models, to ascertain for each model what the implications are for the region's water resources, and to ascertain what effects the water resources have on the economic model.

Our model is composed of two elements: The first element consists of projections of population by age and sex and projections of economic activity by major industry class. The second element is an inter-industry table that shows how the inputs and outputs of one industry in the basin are related to the outputs and inputs of all other industries in the basin and to imports and exports. By "basin" in this context I mean each of six major sub-basins into which we have divided the Colorado River Basin: Upper Main Stem, Lower Main Stem, and Green, San Juan, Gila and Little Colorado. Each sub-basin is treated as an economic unit, for which we construct an inter-industry table and project population and economic activity. The terminal date for projections is the year 2010.

We can speak of the full model only in the future, anticipatory sense, since we have not yet proceeded far enough with our analysis to put the model through a test run. This we hope to do sometime in the near future.

I will turn now to projections of population and economic activity, as they fit into the model.

We first project population, labor force, and economic activity on the assumption that there is an underlying growth in the national economy in which the region will share unless something, such as water, restricts the region's growth. We estimate the national level of output in the years 1980, 2000 and 2010, we allocate an appropriate share to the Colorado River Basin, and then divide this amount among the six sub-basins. In making the projections we assume that the region will move in the next forty-five years along a path relative to the national economy that is a continuation of what has happened in the last thirty or forty years. For example, if food manufacturing in the basin has been growing at a rate slightly in excess of the national average, it is reasonable to project a continuation of that trend since basin population is also expected to grow in excess of the national average. In making this judgment at the initial stage of the projections we do not take into account the possibility that food processing is likely to grow only if agriculture is able to supply the raw material, because we do not know what is expected to happen to agriculture.

The people who are responsible for making agricultural projections, Clyde Stewart and his staff of the Economic Research Service of the United States Department of Agriculture, have a comparable problem. They cannot be sure of the rate of change in agricultural output unless they know how much land will be put under cultivation, which in the Colorado Basin is dependent upon the available water supply. But the available water supply is partly a function of the other uses to which the water will be put, and this is information that they do not yet possess. They proceed by making some reasonable assumptions, in the expectation that further information will be available later.

I might also point out that all of our projections are made at three levels of growth of the national economy, so that we will have a high, a low and a medium, but these will not involve internal combinations of interregional movements, but instead will be dependent upon three rates of growth of the national economy.

After the first set of projections are made, we then total the water requirements. We know that with existing technology there will have to be a specified amount of water evaporated or transpired. We also know that each State is allocated a specified annual quantity of water. The State allocation serves as a ceiling on water supply unless we explicitly introduce other assumptions, such as a designated rate of ground water mining. The results of the first set of projections are illustrated by Figure 1. You see these curves back there.

(Figures 1 and 2 are as follows:)

Fig. 1

Projected Gross Regional Product and Water Supplies

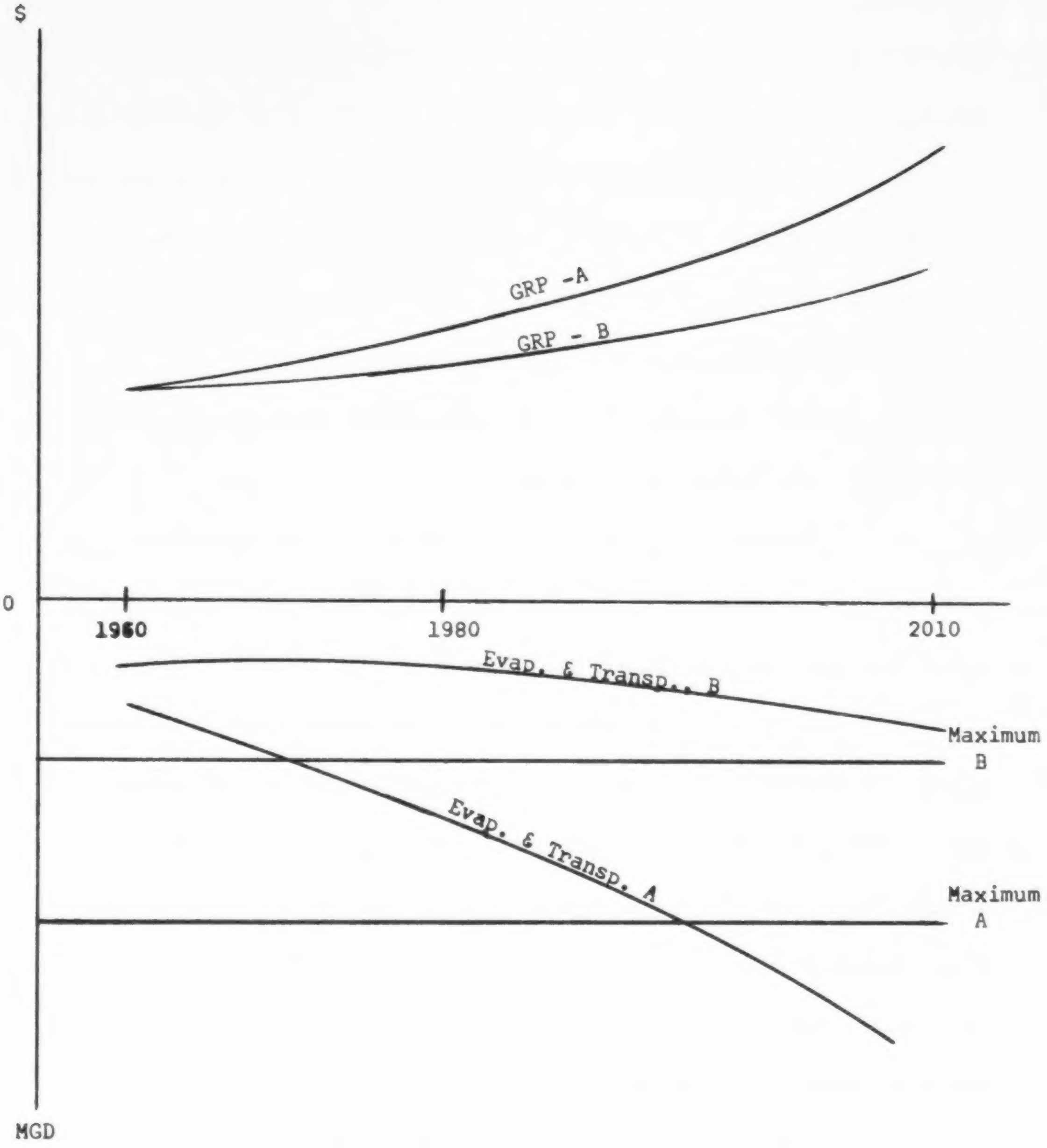
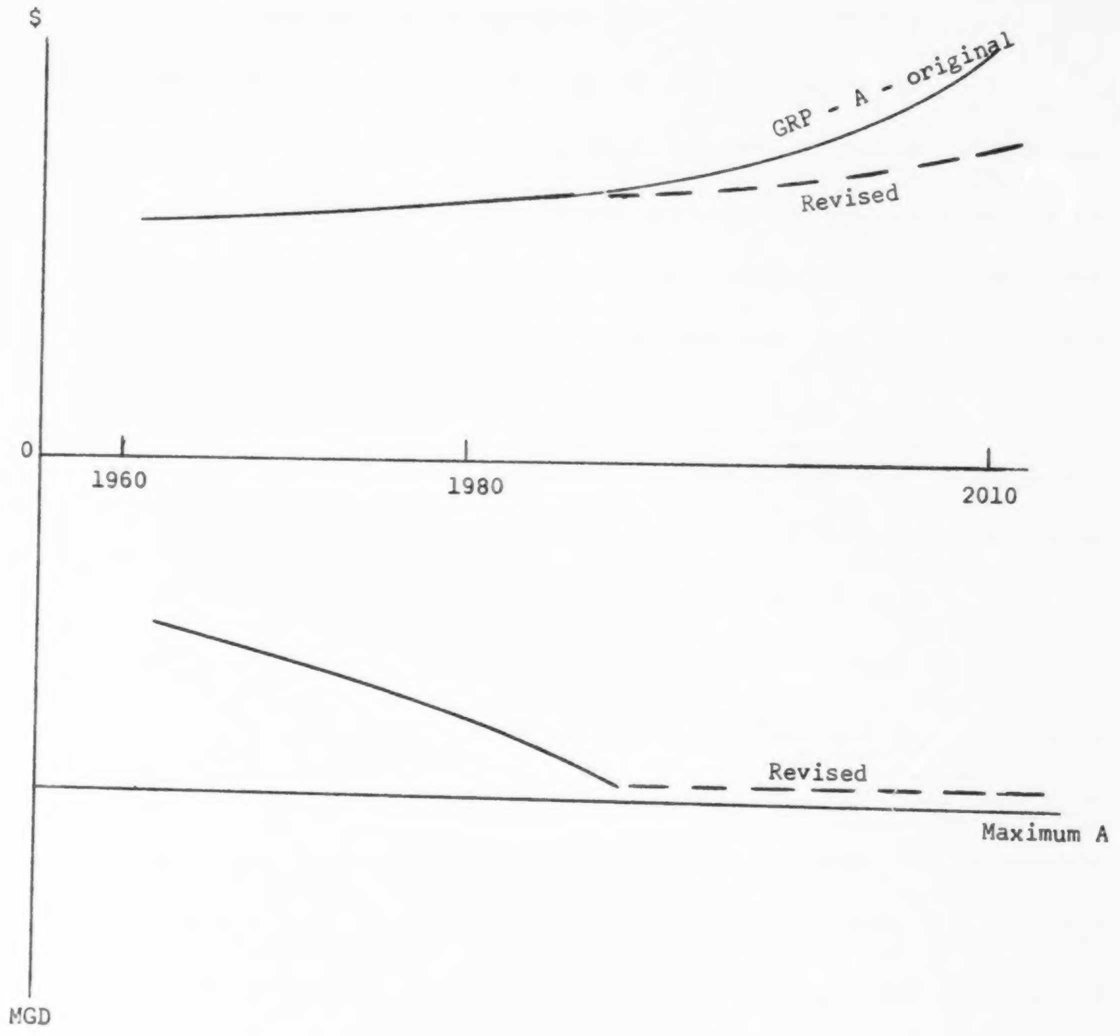


Fig. 2

Projected Gross Regional Product and Water Supplied, Revised



N. Wollman

DR. WOLLMAN: In sub-basin B projected water requirements do not exceed maximum regulated supply. Therefore, we retain the projections for B. In sub-basin A annual losses exceed annual supply. The projections are impossible of fulfillment with regard to water quantity alone.

Let me explain the diagram a little bit.

The center line shows 1960, 1980 and 2010, and correlated with an upward-sloping gross regional product curve is a downward-sloping evaporation and transpiration water requirement curve, measured in MGD. I think there is a head in the way, but it says "MGD."

Now, there are two lines that run across the lower part of the diagram. The upper one of those two lines says "Maximum for B" and the lower one says "Maximum A."

Now, that is a defined maximum of water based on, say, an annual yield, and can be drawn in whatever way we wish to assume. That is, this may assume maximum regulation and complete utilization of the allocated quantity of water, or the maximum may be determined in some other way, but, at any rate, that is the maximum amount available. As you can see, the projection of GRP for sub-basin A intersects the maximum amount of water sometime before the year 2010.

N. Wollman

This simply means that sub-basin A's annual losses exceed annual supply, and the projections are impossible of fulfillment with regard to water quantity alone.

I might parenthetically remark that we can anticipate such things as dissolved oxygen deficiencies or some other waste dilution requirement if we have enough information, and we can provide for waste dilution after a specified level of treatment and incorporate that in our evaporation or transpiration curve.

Dissolved oxygen is not likely to be a serious problem and we therefore will probably ignore it in the early stages of the analysis.

In sub-basin A, the projections have to be modified in order to bring them within the boundaries of the water supply, assuming that quality of water is no problem. We must reduce the original projection by enough activity to reduce water requirements to equality with the available supply. This is illustrated by the next figure.

The revised GRP is that dotted line in the upper half, and the revised water requirements then are correspondingly reduced.

What is important is to note that this revised GRP now constitutes a ceiling value and a projected level of activity of each component is also at its ceiling value.

N. Wollman

By this I mean that nothing that now happens in connection with the rest of the analysis -- in other words, nothing that now happens as a result of taking water quality into account, can raise the projected levels of output from what they are in this figure.

Now, this is a summary of all of the sectors in terms of that simple number, gross regional product.

Before proceeding with the projections, I would like to turn to the interindustry tables, or, as they are frequently called, input-output tables.

We can make projections by using input-output tables -- that is, by using the coefficients and projecting final demands, and so forth, or we can make projections independently of such tables, but there is no device that yields as systematic an understanding of the structure of industry in a region as such a table.

Just as with gross income, there are others upon whom we can rely for data on the national level. There is no one other than ourselves for construction of regional tables.

The father of the input-output table is Professor Leontief of Harvard. He and his assistants are now working on newer and more elaborate tables, but still only limited to the national economy.

N. Wollman

This (Figure [illegible]) is an abbreviated form of the table that we have developed for the Green River sub-basin.

As you can see, there is a listing of activities down the left margin and across the top. The degree of detail is set by our needs and the availability of information. In the lower three sub-basins we constructed a more elaborate table than we used in the Green. For example, in the lower basins we divide agriculture into ten sectors, whereas here in the Green everything is put into one, which is called "Agriculture."

I don't suppose you can see those numbers, but in that upper left-hand corner where Agriculture is on top and Agriculture is to the left, the number in there is $8,117,000, so that number says that $8,117,000 worth of agricultural output went into agriculture, such as in the form of seed, cattle feed, breeding cattle, and so forth; $200 went into mining, and $4,541,000 went from agriculture into the manufacturing of food and kindred products, and so forth, if we were to fill in all the numbers.

Now, the inputs into agriculture are indicated by starting at the top and going down. For example, inputs into agriculture amounted to $8,117,000 from agriculture. There was a zero input into agriculture for mining, and there was a $887,000 input from food and kindred products into agriculture, which was mostly in the form of processed feed and items of that sort.

Now, the full table indicates several factors that are not industries, and you can see a heavy line partway down the table, and that separates what we call the processing sector from the sectors of final demand. The final demand sectors are household, capital investment, Government and exports, when read across; and they are household, depreciation, Government and imports when you go down.

The gross output of an industry is that which goes to all other industries, plus that which goes into final demand, and the gross outlay figures on the bottom are the gross inputs that go into the industry in the column above.

So we have the gross outputs on the far right, and the gross inputs reading across the bottom.

The degree to which final demand sectors are subdivided is also a matter of discretion, just as the subdivision of the processing sector, and the degree of division will depend upon analytical needs and the availability of data.

In our own table, we have divided "Government" into two sectors: One is State and Federal and the other

N. Wollman

is local. It is not shown that way here in this illustration.

Exports are also divided into two sectors, of which one is exports to other basins in the Colorado, and the other is the rest of the world.

The input-output table is a versatile tool. First of all, it is an instrument for estimating gross regional product. Gross regional product is not the gross market value of output as indicated that far column, because such a number is likely to count the same product several times, depending upon the structure of industry.

For example, if we add the market value of the wheat sold by the farmer, the flour sold by the miller, the bread sold by the baker, and the bread sold by the supermarket, we overstate the total product produced in the region because we have counted the wheat in the final product four times, the flour three times, and the bread itself twice.

We can eliminate overcounting by adding together the components of final demand -- households, governments, capital additions, and exports -- and from that total we subtract imports. The figure that remains is gross regional product. If we subtract depreciation from one of the lower rows, then the figure that remains is regional net product.

N. Wollman

From the point of view of water quality problems, we need to know the gross output of water-related uses, in order to ascertain water use and water pollution. From the point of view of measuring the economic structure of the region, we need to know the contribution of an industry to regional gross product. Both measurements are important and both are provided by an input-output table.

A more sophisticated contribution of the input-output table is in its ability to measure the total effect on a region's economy of a change in the output of any one industry. This is done by converting the input-output table from a table of transactions, such as here, to a table of coefficients.

May I have the next figure?

This table (Figure 4) is a table of the direct coefficients, and they are computed for each sector by dividing each input by the total of inputs.

We see, for example, that the input of food and kindred products into the agricultural sector was $887,000. You saw that in the transactions table before. It was about $887,000 out of the total inputs into agriculture of about $49 million.

This means that on the average, a one dollar output of agricultural product requires an input from food and kindred products of about 1.8 cents. If agricultural output grows by $100, its purchases from the food and kindred products industry will grow by $1.80. Input of agriculture into the food and kindred products industry, looking at the path in the other direction now, is about 4-½ million dollars, while total output of the food and kindred products industry is about $8,300,000.

Therefore, a one dollar increase in the output of the food and kindred products industry requires an increased input from agriculture of about 55 cents.

These are the relations that are revealed in this table. These are the relationship curves, one dollar out of any of the industries at the top.

For example, here it shows that approximately 17 cents worth of agricultural inputs will be required for one dollar's worth of agricultural output. It shows here the 1.8 cents of food and kindred products inputs that will be required per one dollar's worth of agricultural output.

The column headed "Mining" shows that it takes something like five or six zeros plus a five at the end. Those are in dollars, so it is about what? Five-thousandths of a cent of agricultural product per dollar's worth of mining output. That is what that number says.

Under the food and kindred products column,

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the number, .55, says that for each dollar's worth of food and kindred products output -- now, that, of course is a very broad category consisting of dairy products, meat products, soft drinks, liquor, et cetera, et cetera, and tobacco is included in it too -- it will take 55 cents worth of inputs from agriculture.

Now, the increased output of agriculture that induced an increase in the output of food and kindred products -- you see that there -- one dollar's worth of agricultural output will induce 1.8 cents worth of additional output of food and kindred products, and now induces a further increase in the output of agriculture because there is an agricultural input into the food and kindred products industry, as you see in the third column in the first cell.

This is only the beginning. It is a one dollar increase in the output, if we had the whole table filled in, and induces increased input of varying amounts from all other industries that provide input. Many of these will in turn require additional inputs of agricultural products, as well as additional inputs of food and kindred products, which in turn will require more agricultural products.

These interindustry effects create sets of infinite series and tend to come very close to their limit

N. Wollman

after a reasonable number of rounds.

The total effects are incorporated in a table of direct plus indirect coefficients (Figure 5).

This table shows what a one dollar increase in the output of agriculture will do when all subsequent rounds of interindustry effects are taken into account. For example, a one dollar increase in the final demand for agricultural products will raise the required output of agriculture by $1.21, and the required output of food and kindred products by 2.2 cents.

If the final demand for food and kindred products rises by a dollar, the total increased output of agriculture will rise by 67 cents.

You will recall the preceding table, that for every one dollar increase in the output of agricultural product there was a requirement for 55 cents worth of agricultural input, but if we raise the final demand for food and kindred products by one dollar and then trace through all subsequent effects, the way it ends up, with respect to agriculture, is that instead of an increase in agricultural output of 55 cents, it amounts to about 67 cents.

Now, wherever we talk of increased outputs, we can also talk about reduced outputs. Hence, we can quickly ascertain the total effect on a basin's output, once the coefficients are established, for any given change in the output of a given industry.

For example, a one dollar reduction in the final demand for food and kindred products will reduce the inputs of agriculture by 67.3 cents, the inputs of mining by about 1 cent, and bring about a total reduction in food and kindred products by $1.02.

This raises two points which deserve attention. A relatively large share of our research effort is going into determination of these coefficients. We could have used national coefficients, as has been done in a number of regional studies. We have found, however, that there are substantial differences between national coefficients and those applicable to the Green.

We have just been completing the computations for the other sub-basins, and I have as yet not had a chance to compare the coefficients of the other sub-basins with the coefficients of the Green or with the national coefficients.

The second point in this regard deals with changes in the coefficients. Investigations have shown that over a decade the coefficients are likely to change in varying amounts as a result of changes in technology and relative prices, but the significance of most of the changes is still being discussed in the literature.

N. Wollman

In many cases very large changes in given coefficients have relatively little absolute effect. Furthermore, where we have reason to believe that a change is probable, we can readjust our coefficients for 1980 and 2010 in whatever manner seems reasonable.

We now come to the way in which economic and water quality data interact.

After the first projections of population, irrigated agriculture, and major water-using nonagricultural activities have been made, the engineers and scientists of the Public Health Service will develop estimates of the following five items:

First, the expected quality of water as a result of projected activity;

Second, the expected levels of waste treatment and the relationships between treatment levels and the quality of water;

Third, the effects of changes in water quality on the costs of water users;

Fourth, the effects of changes in water quality on the uses to which water can be put; and,

Fifth, the alternative techniques of pollution abatement and their costs.

We anticipate that the engineering findings will yield two cost curves. One curve will relate the costs of water to the user with the degree of pollution.

Assuming that we can speak of pollution in a single form as representative of the general problem, we anticipate a function such as this (Figure 6).

On the horizontal axis is total dissolved solids, increasing in concentration as we move rightward. This curve is an aggregate for all water users of the region, and is, therefore, based upon a specific projection of economic activity and population. The curve shows that the greater is the concentration of TDS, the higher are aggregate costs to all users. Costs include water treatment, reduced productivity per unit of water, increased damage to equipment, increased inputs of other factors to offset reduced productivity of water, and so forth.

Figure 7 is a pollution abatement cost curve. This will be actually an envelope -- the heavy underlined curve that is farthest to the left -- an envelope of a number of curves, marking out the path of the most efficient technique of achieving a given reduction in TDS.

Like the curve in Figure 6, the curve in Figure 7 is a total outlay curve, total for the region, and includes private as well as public outlays. Because it is a total outlay curve, it is based upon the projected level of population and economic activity. The curve starts at the level of raw water. The techniques and their relative position are purely illustrative, because we do not yet have any of the data.

The two curves can be combined into a single curve that shows the total cost of water to users and for pollution abatement. Since the projected level of output is given, GRP can be represented on the same diagram by a straight line.

May we have the next diagram, please (Figure 8)

The combined cost curves -- you see, those are the two cost curves that we have talked about before, user cost going up to the right, abatement cost moving up to the left -- if you add those two curves, vertically from any point on the horizontal axis, and you get the total water cost curve, that saddle-shaped curve in the middle of the diagram.

The vertical axis is not in scale. According to this diagram, for the given level of population and output, the minimum total cost of water is OC dollars, and stream quality at this minimum is a TDS concentration of OM, which you can't see, but it would be on the horizontal axis just below that low point on the total cost curve.

N. Wollman

The next step of the analysis is to experiment with the model by assuming that a designated polluting activity is reduced in amount. This means that gross output is reduced by an amount -- why don't you just hold off the slide there for a minute, because I will wait and give you the signal so it won't burn up.

Let me repeat. That is what we then do, is reduce a designated polluting activity by a certain amount. This means that gross output is reduced by an amount equal to the product of the direct and indirect coefficients of our input-output table, multiplied by the dollar's worth of assumed reduction in final output. By reducing a polluting activity we raise the quality of raw water, and therefore move the pollution abatement curve to the left. The change in projected gross output may also move the user cost curve to the left. In other words, our water quality is higher because we have removed the polluting activity. Therefore, the in-stream costs are less for any given TDS concentration and the user costs are less for any given concentration.

Now, the user cost curve will move to the left, depending upon the activity that is assumed to be reduced in amount. If this activity contributes to pollution, but is itself not bothered by pollution, either by virtue of

N. Wollman

location or character of production process, then the user cost curve is unaffected. In either case, we now have two new curves to put together, and from the new gross output curve we have a new GRP, which is the original GRP minus the specified reduction in final demand, and a new total cost of water curve. These are illustrated in this next diagram (Figure 9).

Here we have two GRP's up there and two different total costs of water curves. Those are the saddles that are the sums of the other two cost curves. The various cases that we have been examining can be compared most easily by subtracting from each of the projected GRP's the appropriate cost of water curves, and these results are illustrated in the next diagram. I think this is the last one, so we may not burn up yet (Figure 10).

(Laughter.)

The initial projection is labeled A, and from A we subtracted the cost of water, the appropriate cost of water curve, so that is GRP, not a water cost. The others are listed in alphabetical order, B and C, and so forth.

Whether any projection of GRP net of water costs, when water costs are minimized, will yield a higher value than the initial projection, will depend on the amount by which water costs fall relative to the decline in GRP.

N. Wollman

Let me point out one thing that may be of great interest as this study develops. Of course, the proper point to be at is at the peak of the highest curve in terms of maximizing GRP net of water costs.

Now, it might conceivably turn out that no matter how we put activities in or take activities out, the peaks of the various GRP net of water costs curves tend to fall in a vertical line. In other words, they tend to be opposite a given TDS, and TDS is just about where Murray Stein's head is, so that is the horizontal axis, the TDS right there. It could conceivably be that a relatively wide variation in economic activity and costs of water all will yield a relatively uniform salinity or pollution concentration, as the case may be. This may be a considerable help in terms of policy.

I think we are finished with the machine -- no, we have a couple of tables that I just illustrate some numbers with.

From an economic point of view we conclude that the optimum pattern of water use is given by the curve of GRP net of water cost that has the highest peak, and the optimum level of stream quality is given by reading off the TDS concentration for the peak GRP net of water cost.

There is one qualification to this conclusion:

N. Wollman

The user cost of water at this point cannot be so high that it puts anyone out of business. If water costs rise high enough to compel abandonment of an activity, GRP net of water costs must be recomputed without the activity in question.

By adopting the criterion of maximum GRP net of water costs, we simultaneously maximize GNP. This hasn't anything to do with what is on the screen, so you might ignore that for a moment, but let me repeat this because I think it is also of significance.

By adopting the criterion of maximum gross regional product net of water costs, we simultaneously maximize gross national product. This conclusion rests upon the assumption that the economy of a basin or sub-basin is an "open economy," that is, factors of production, finished goods, capital, raw materials, and so forth, can move into and out of the region from and to other regions. In addition to the assumption of an open economy, our criterion depends upon two other assumptions:

(1) The productivity of any displaced factor will be as high in the region to which it migrates as in the basin for which it is initially projected before water quality was taken into account;

(2) The marginal costs of water will be no

higher in the region to which the displaced factors migrate than in the basin from which they come.

Both of these assumed conditions are reasonable when applied to the Colorado River Basin. The outflow of factors is likely to be small relative to the supply of factors in the receiving regions, and therefore not likely to induce a perceptible decline in marginal physical productivity. And unless the migrating factors move into a region in which water problems are as acute as they were in the region from which they have come, the marginal costs of water are likely to be lower in the receiving region than in the originating region.

Before concluding with a brief reference to Tables 1 and 2, I want to call your attention to a problem that I have ignored.

The model implies that water supply is, to borrow Jim Coulter's phrase, a "community well." In other words, we have not taken into account the problem of spacing along a stream. We are not yet ready to say what will be the best way of handling this problem. We are prepared, if necessary, to make our projections by county, with the hopes that we can work with larger units, since the reliability of projections varies inversely with the size of the region for which they are prepared.

N. Wollman

Tables I and 2 are just a few samples of the projections that we have made. Table I shows projected gross outputs for the industry sectors used in the input-output tables for the Green.

As you can see -- maybe you can; I don't know -- as you can see, the expected rate of growth between now and 2010 varies widely among industries. A decline is projected for chemicals, petroleum refining, and coal products, whereas expenditures on lodging are expected to grow about nine times. Food and kindred products are expected to grow about 25 percent, whereas the output of lumber and wood products is expected to triple. Until we have completed all sub-basins, however, the projections for any single sub-basin must be considered as tentative.

Table 2 shows the medium projections, made for us by Bill Leasure, of a group of counties in the lower part of the Colorado River Basin. Today's populous counties are projected to continue their growth, with an effect on adjacent counties. If a 2010 population of about 4-½ million people for Maricopa County seems somewhat extravagant, remember that a medium projection for the United States is 330 million people by the year 2000, and about 375 million by the year 2010.

Incidentally, at the high projection, Clark

County is 1.7 million, Maricopa 5.9, and Pima 1.6.

Not all the counties are expected to share in the boom. Greenlee in Arizona, Washington in Utah, Lincoln in Nevada, and Catron in New Mexico, either decline or remain stable. While real estate speculation appears to be less favorable in these counties than elsewhere, their very emptiness may turn out to be the asset that will attract all the people who are looking for what will be a self-defeating search.

Thank you.

(Figures 3, 4, 5, 6, 7, 8, 9, and 10, and Tables I and 2 attached to Dr. Wollman's statement are as follows:)

Figure 3

Interindustry Transactions, Green River Subbasin, 1960

($ 1000)

	Agriculture	Mining	Food & Kindred Products	Etc.	Government	Households	Capital Investment	Exports	Gross Output
Agriculture	8117	.2	4,541						49,000
Mining	0								184,400
Food & Kindred Products	887								8,253
Etc.									
Etc.									
Government									
Households									
Depreciation									
Imports									
Gross Outlays	49,000	184,400	8,253						

Figure 4

Direct Purchases Per Dollar of Output, Green Subbasin, 1960

	Agriculture	Mining	Food & Kindred Products	Etc.	Etc.	Government	Households	Capital Investment	Exports	Gross Output
Agriculture	.166	.000005	.55							
Mining	0		.0034							
Food & Kindred Products	.018		.0075							
Etc.										
Etc.										
Government										
Households										
Depreciation										
Imports										
Gross Outlays										

Figure 5

Direct and Indirect Requirements Per Dollar of Final Demand, Green Subbasin, 1960

	Agriculture	Mining	Food & Kindred Products	Etc.	Etc.	
Agriculture	1.21	.00072	.673			
Mining	.007		.0105			
Food & Kindred Products	.022		1.02			
Etc.						
Etc.						

Fig. 6

User Costs Related to TDS

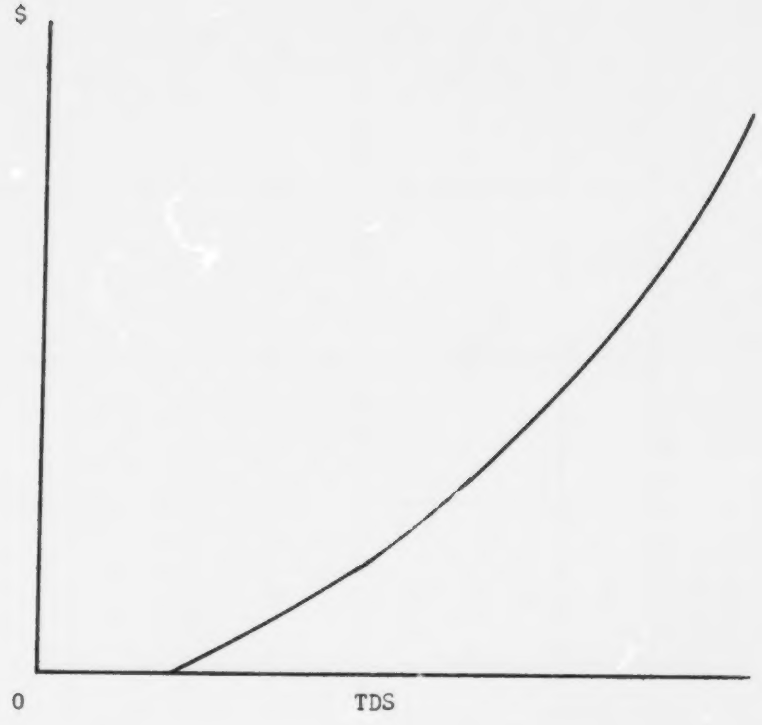

Fig. 7

Pollution Abatement Costs

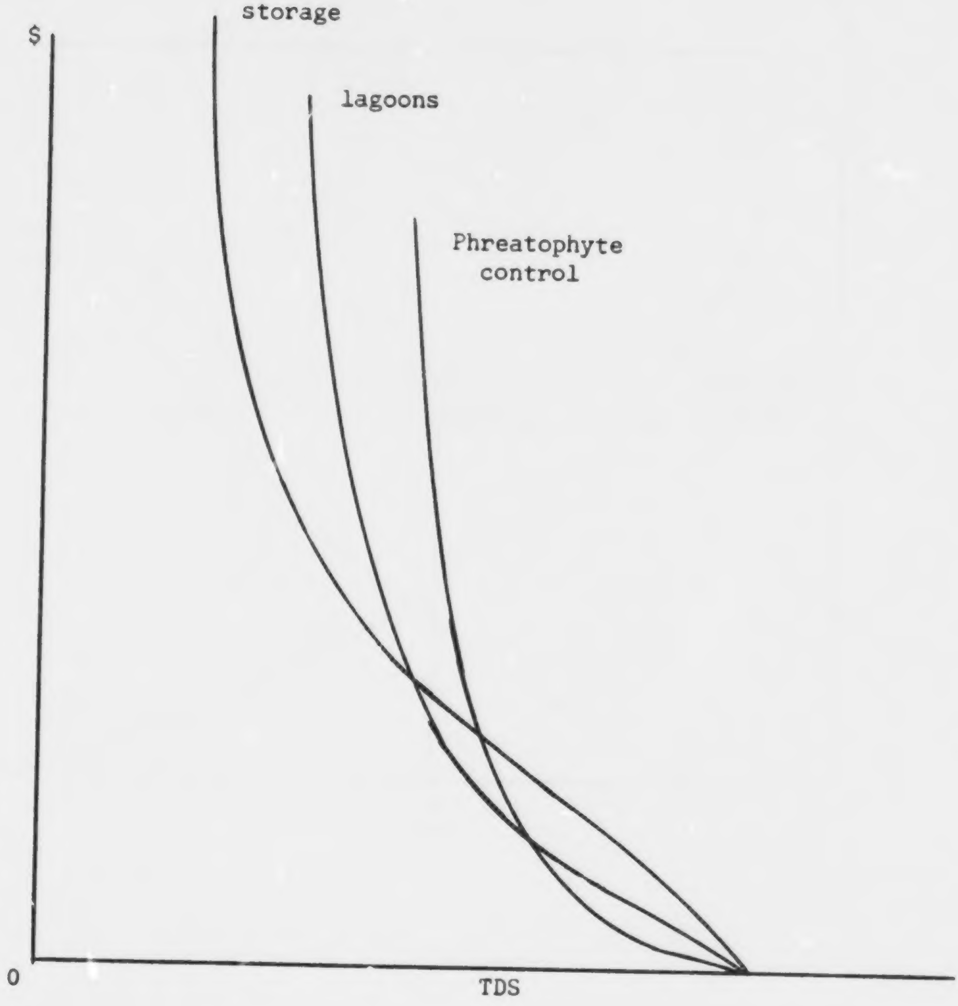

Fig. 8

Costs of Water as Function of TDS for Given Projected GRP

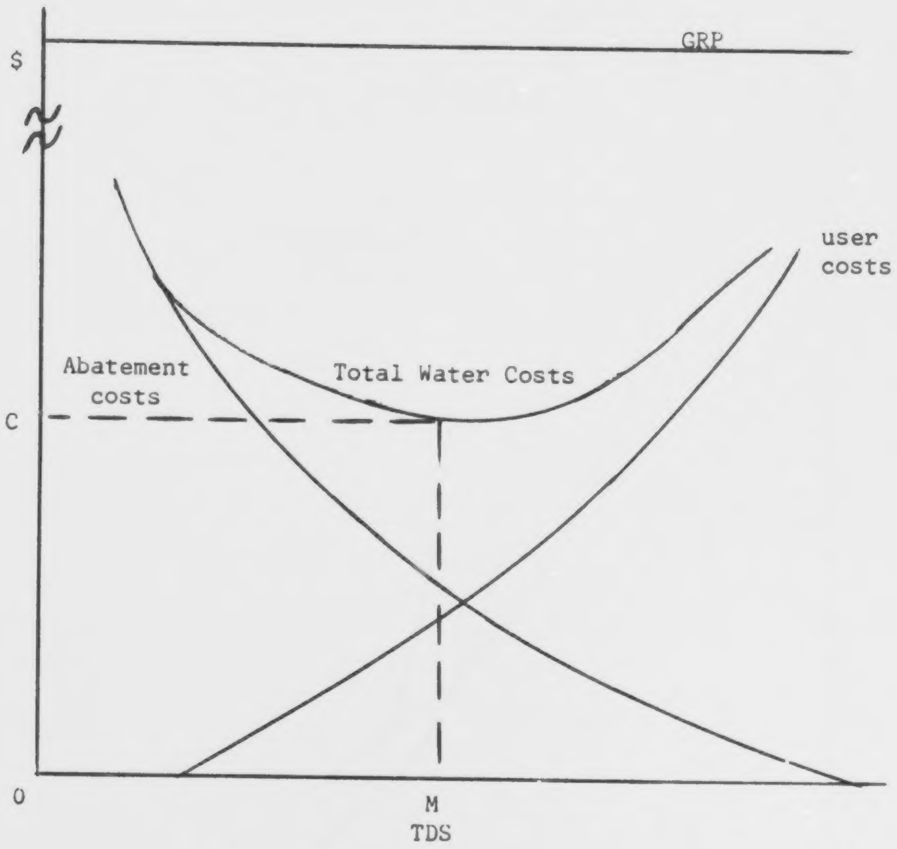

Fig. 9

Revised GRP and Costs of Water

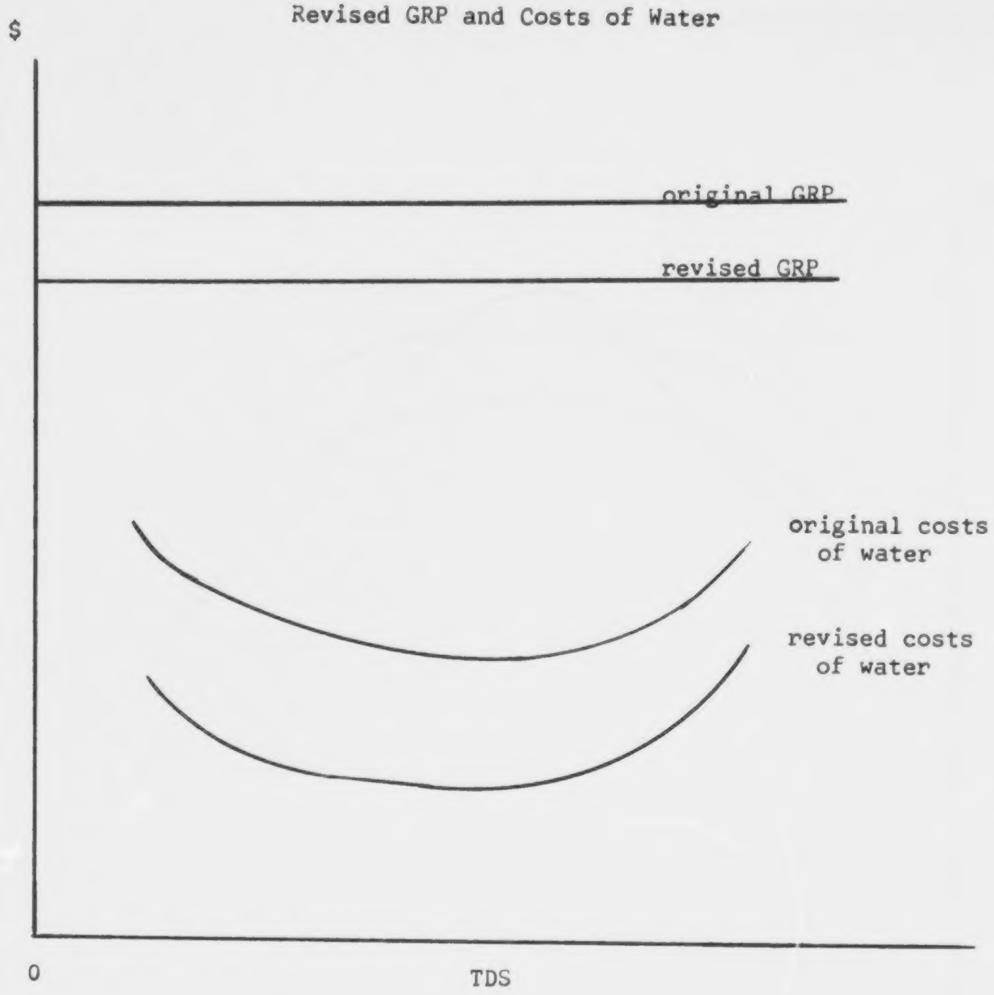

Fig. 10

Alternative Projections of GRP Net of Water Costs

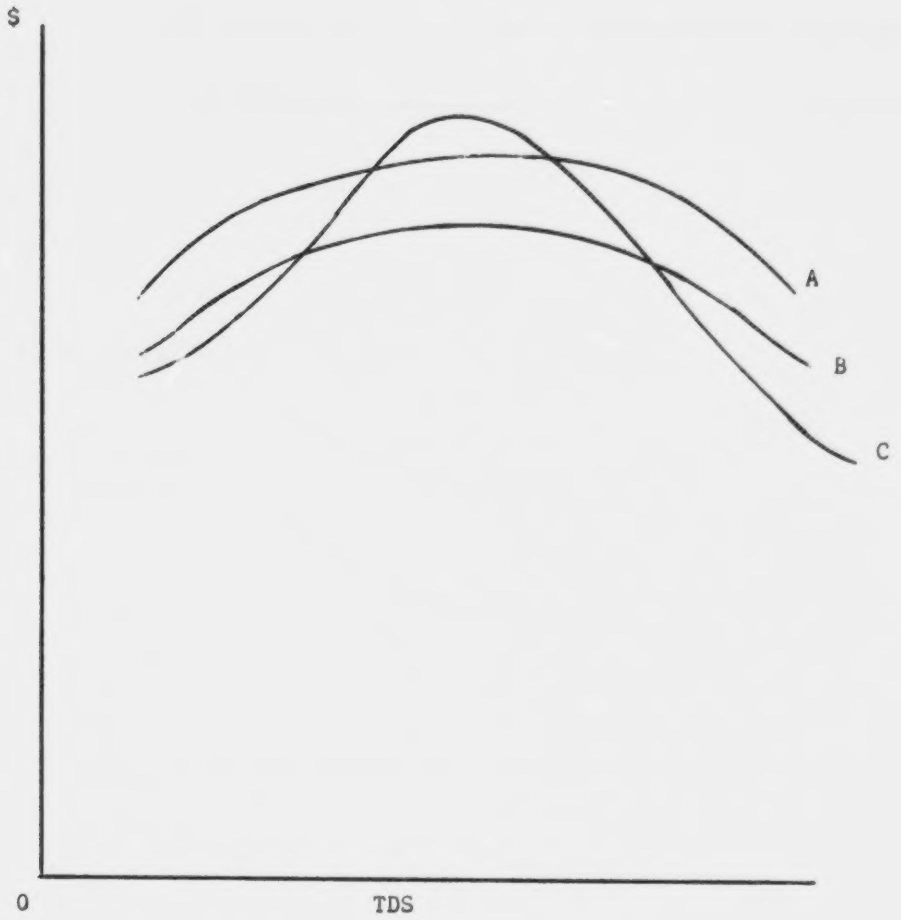

Table I

Tentative Projected Gross Output, Green Sub-basin

($ mil.)

	1960	1980	2010
Agriculture	49	67	76
Oil & Gas	119	177	269
Coal	46	55	61
Uranium & Other	20	19	25
Food & Kindred Products	8	10	10
Lumber & Wood Products	4	6	12
Printing & Publishing	.8	1	2
Stone, Clay, Glass	2	2	4
Chem., Petroleum, Coal Products	4	2	2
Wholesale	10	15	25
Auto. & Gasoline Sta.	4	10	19
Eating & Drinking	5	10	22
Other Retail	39	55	83
Oil Field Services	7	4	6
Lodging	8	25	74
Other Services (non-prof.)	10	17	37
Transportation	24	30	45
Electric Energy	16	31	49
Other Utilities	9	13	23
Contract Construction	54	72	123
Rentals & Finance	26	39	64

Table 2

Population Projections, Medium Rate of Growth, Selected Counties, Colorado River Basin

(1000's)

	1960	1980	2010
Clark	127	397	766
Maricopa	664	1,974	4,409
Pima	266	592	1,224
Apache	30	67	108
Coconimo	42	116	220
Gila	26	31	33
Graham	14	22	27
Mohave	8	18	24
Navajo	38	98	158
Pinal	63	125	190
Santa Cruz	11	27	42
Yavapai	29	46	59
Yuma	46	112	196
Greenlee	12	12	12
Washington	10	11	12
Lincoln	2	2	1
Catron	3	2	2

MR. STEIN: Thank you.

Are there any comments or questions?

Mr. Bonderson?

MR. BONDERSON: Just somewhat of a question or observation.

This all sounds very interesting and very logical. As it relates to water quality control, this has never been tried before, has it?

DR. WOLLMAN: I don't think so.

MR. BONDERSON: This is a very pioneering effort, to say the least?

DR. WOLLMAN: From the general state of ignorance in which we find ourselves from one day to the next, I think this is a relatively new approach.

MR. BONDERSON: Is there any indication as yet as to what kind of curves you are going to get out of this?

DR. WOLLMAN: No. We have the economic curves. Yes. That is, we have the various paths of projections of economic growth, and they are pretty well finished for the Green and the three lower sub-basins. They are still in tentative form, until we put all six basins together, but we do not as yet have any of the water quality data that will go with the economic projections, nor the cost curves.

These are the curves that Public Health Service has recently begun to develop.

MR. BONDERSON: In the early part of your discussion, on Page 3, you state, "We can speak of the model only in the future."

DR. WOLLMAN: Right.

MR. BONDERSON: And sometime in the future, you hope to put this to an actual test run. What do you mean by that?

DR. WOLLMAN: Well, what we hope is that we will be able to get from Public Health Service the data that will go into the cost curves, the pollution abatement and the user cost curves, and we will see to what degree we have to aggregate or disaggregate the various economic projections to take care of the problems of going from point to point down the stream, whether we can divide the sub-basin perhaps into two halves or three thirds, or something of the sort, or whether we can work with the basin as a single aggregate before ending up with the aggregate curves.

We are not sure yet how we will use these.

MR. BONDERSON: When do you think you will be able to do this time-wise?

DR. WOLLMAN: I think Jack Rademacher is probably the best person to answer that question.

MR. RADEMACHER: Well, I think that the schedule still stands, that we will have the adjustments due to water quantity constraints completed by the end of this next year, and then the water quality constraints in them in the following year.

MR. BONDERSON: It will be another two years then before you really can put this through the acid test?

MR. RADEMACHER: Well, the constraint says they are put in. We will give it the acid test, as I understand it, and we will come up with the projections based upon the economic and engineering aspects during that second year.

Does that answer your question?

MR. BONDERSON: Yes. One observation here?

MR. STEIN: Yes, go ahead.

MR. BONDERSON: This Table 2 is mighty revealing, and when we start thinking about four and a half million people in Maricopa County, I think this gives a great deal of justification and weight to the wisdom of what we are trying to do right here, and that if we don't try to do a little advance planning for the tremendous growths that are projected, I would say that we are in trouble.

I think we are doing a wise thing here myself.

MR. STEIN: Well, I couldn't agree with you more. I think that without even the refined projections, just some of the insight you get by going through these figures and seeing what kind of potential you are going to have in population and in business, and so forth, will lead you to recognize the problem.

Of course, in the area we are dealing with, this is a matter of life and death. As Dr. Wollman has stated, it is just something we are experiencing all over.

It is less than ten years ago that where I lived everyone had a well and a septic field. I still have a well. Right now they have four-lane highways and high-rise apartments. Obviously, ground water is not feasible any more, and they are laying tremendous water lines all over the place.

The difficulty is when you get down here, if you lay the water lines, how are you going to fill them up? I think this is precisely the problem we have to face in this area.

Are there any other comments or questions?

(No response.)

MR. STEIN: If not, thank you very much for a comprehensive statement.

DR. WOLLMAN: You are quite welcome. I certainly enjoyed being here.

MR. STEIN: We certainly enjoyed having you.

This will give you an indication of the kind of problems you have.

One thing more before we go. I think in the Federal-State relationships, we rarely get called in or we rarely come in unless there is a tough problem, and we pretty generally find ourselves on the forefront of new developments and new techniques and new knowledge. I think this is probably the way it should be.

Now we will recess for lunch. If we could take an hour and a quarter for lunch, that would indicate that we can return at ten minutes to two.

We stand recessed until ten minutes to two.

(Whereupon the conference recessed until 1:50 p.m. of the same day.)

AFTERNOON SESSION

(1:50 p.m.)

MR. STEIN: May we reconvene?

Mr. Klashman?

MR. KLASHMAN: Our next presentation will be by Dr. Ernest Tsivoglou.

Dr. Tsivoglou.

MR. STEIN: Off the record.

(Discussion off the record.)

STATEMENT OF DR. E. C. TSIVOGLOU, SANITARY ENGINEERING DIRECTOR, UNITED STATES PUBLIC HEALTH SERVICE, ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO

DR. TSIVOGLOU: We have actually quite a lot of radioactivity data, and I will do my best to be brief and quick about it and hope that I don't leave a lot of unanswered questions.

Incidentally, there was a copy of a draft or part of a statement on effluent monitoring that was mistakenly given out by the project this morning. I wish you would ignore it because there have been some changes made.

The 27 radium monitoring network stations maintained by the project continued to operate during the past year. There have been no significant changes in overall average radioactivity levels from those reported at the past conference at the last session.

The sensitivity of the network was recently demonstrated in the case of a gradual rise of Radium 226 below the uranium mill at Uravan, Colorado, during the winter.

The project was aware of the rising trend and was able to follow it through its course and see it diminish again after a couple of months.

When I say there was a rise, it was not a large rise. It was -- oh, I think the levels went up temporarily to about three micromicrocuries per liter, which was not especially, over such a short period, regarded as anything hazardous. In fact, we have noted other such brief fluctuations at other stations, and why they happen, we are not sure.

We think in the Uravan incident, they have put in a recent improvement program in terms of waste handling, and we expect that there was perhaps some temporary need to release effluents in the case of making the necessary changes in waste disposal.

We have even had brief transitory changes that we think result from perhaps our making up samples in the laboratory or in the field.

Only six of the 928 composite samples collected since 1961 have had Radium 226 above 3 micromicrograms per liter. No network station has exhibited an overall average above this level. Only two stations have had an average radium concentration near the one micromicrogram per liter that we suggested as a reasonable objective a year or two ago. In those two cases, they are borderline and not a problem.

The natural background concentrations of radium continue to average below 0.1 micromicrograms per liter. The non-background stations average about 0.3.

As I said, I am going to try to hustle through quite a bit of this, but I hope I don't sound too disjointed.

In addition to the Radium 226 records, we have 15 months of consecutive data now available on dissolved uranium concentrations, and these also have provided information as to the natural background levels, as well as average levels below uranium mills.

In the upper reaches of the basin, concentrations below 4 micrograms per liter seem to indicate background. An average of about 2 micrograms per liter has been found at the background stations themselves, or a group of them, while an average of about 11 micrograms per liter prevails at non-background stations.

I am not going to attempt here to report the result on thorium, lead content or polonium content. We have had a few analyses. It is not enough that we think we want to try to present average figures at this time. They are continuing. They will be reported shortly in the project reports.

We have had no results that exceed maximum permissible concentrations or allowable limits, although we have had a few that are higher than, well, let's say, several times higher than background levels. But we would prefer to hold off until we have more data and until we have time to interpret what we are getting.

The statement includes a tabulation of the monitoring network results for radium and uranium, and a map showing average levels. I won't try to refer to those here, but they will be included in the transcript.

So far as the sediment surveys are concerned, there have been seven completed to date. The last one was conducted this past March.

The number of sampling stations has been reduced from the original 88 to 30. These 30 stations now provide an adequate sediment surveillance network. The data provides some insight into long-term stream contamination as contrasted to the instantaneous or short-term levels which you find in transitory water samples.

The data have accumulated for quite a while. We find that if we use the figure of about 15 percent, we can estimate radium concentrations in sediments from a gross alpha assay, and although we haven't come to a conclusion on this yet, I suspect in the future we may do more gross alpha and less radium analysis and save the laboratory.

We found this 15 percent figure to be pretty consistent. We get occasional deviations, but we suspect that they are not real, but may be a problem either in representative sampling, or, more likely, analytical work.

Briefly, some of the findings so far in the sediment network are that the background sediment collection stations indicate an average 1.1 micromicrograms of Radium 226 per gram of sediment, about 8 micromicrocuries per gram of gross alpha contamination. Non-background stations indicate about 2.6 micromicrocuries per gram, or roughly two times the background locations. The same thing holds for the gross alpha activities.

I would like to skip over a little of this, if you will bear with me and go to the Monticello surveys, and mention them very briefly.

E. C. Tsivoglou

As we indicated last year, we have conducted one more sediment and water survey in the stream below Monticello, Utah. The results from this survey show a continued general improvement in the radiological situation in the stream below the mill site. Both the sediment radium concentrations and the water radium concentrations are down from the most recent levels that we had last year. All of the levels of Radium 226 in water except at Sorenson's Well have dropped below 3 micromicros per liter. The artesian well continues to average about 4 micromicrocuries of radium per liter, as it has since the first survey we did in November of 1961.

The farm itself is abandoned. The well is not in use, but that would indicate that perhaps the contamination in that well is not directly the result of the uranium tailings that have been in the creek, but the result of something else perhaps.

Radium 226 concentrations in the stream immediately below the mill site averaged 1.5 micromicrocuries per liter. Uranium was higher. It averaged 1,300 micrograms per liter, but this is still far below an allowable limit in the case of uranium.

Whether we will do much further monitoring below Monticello is something that we will have to look into.

The situation seems to be improving steadily, just as it should, and this may be a place in which we can minimize some of the laboratory work. Perhaps we can cut the number of stations and perhaps we can eliminate the survey.

I would like to mention briefly the crop studies that we mentioned last year. We discussed at that time briefly the subject of Radium 226 and its effect on crops. We noted results as high as 1,160 micrograms of radium per kilogram in pasture grass, and commented that in general this radium content in crops appeared to be related primarily to topsoil rather than the irrigation water radium concentrations.

We did some preliminary sampling before our last conference to establish guidelines for a more definitive analysis. We thought that we would have considerable results to report this year, but it turned out that by the time we finished the last session and began to look at the question of crop uptake of radium, we were already too late really to establish a good program to measure this. The irrigation and the crop season was well underway, so instead we deferred heavy sampling programs -- "heavy" is a relative term too -- until this year, and this was begun in March of this year.

We have obtained the cooperation of several

E. C. Tsivoglou

farmers in the Grand Junction, Gateway and Durango, Colorado, areas, and have made arrangements for sample collections from their farms. The samples will include soil, crops, irrigation water, milk and fertilizers. We have completed analysis on ten of the fertilizers collected. The radium concentrations ranged from zero to 21 micromicrocuries per gram of fertilizer. On the same samples, uranium ranged from zero to 120 micrograms per gram.

I think we have pointed out before that the crop studies are something beyond the scope of the Colorado project by itself, and the Sanitary Engineering Center has been interested. We have arranged for some samples from the phosphate fertilizer industry in Florida, and these have been received in Cincinnati and these will be analyzed for the various isotopes, and will become a part of the overall story that we are developing.

I would like now to turn to the work we have done during the past year on effluent monitoring. It has been a considerable amount of work so far as our laboratory is concerned, although it represents only two samples, one last summer and one in the winter, from the operating mills.

A total of about 40 samples have been analyzed for a variety of isotopes, in an effort to account for all of the isotopes. We have not really accounted for all of the isotopes, but we have come reasonably close to accounting for those with which we should have some concern.

Each sample has been analyzed for its content of Radium 226, Lead 210, Polonium 210, Thorium 230, or the alpha-emitting thorium isotopes, and uranium. These are presently regarded as the ones we are concerned with.

I would like to note here that this analytical work load has been large, although only 40 samples have been involved, in that several of the analyses are tedious and time-consuming, and especially a good deal of analytical methods development has been necessary.

In this regard, for example, until the past few months, no suitable analytical method for Lead 210 was available for complex samples, such as uranium mill effluents.

I would remark aside that in my discussions here last night and today, I think still that there is not much in the way of analytical methods available that one can depend upon, except we think now for the one that our laboratory has developed.

Methodology for Polonium 210 has also had to be perfected. All of this has resulted in a considerably larger burden on the laboratory than was anticipated a year ago, when we began this.

As a result, among other things, the analyses for these other isotopes in our stream monitoring network has had to be in fair part deferred, but these figures will come and they will be given in the project report in a few months.

The results of the effluent and pond liquid radioassay are given in a table. I am not sure if that table has been distributed or not.

MR. KLASHMAN: It has.

DR. TSIVOGLOU: This is referred to as Table 1, "Average Liquid Wastes Radioactivity Content" (P. 144).

Do you all have that? Good.

In almost all cases, the result reported in Table 1 represents the average of only two samples, one taken during mid-1963 and the second during the winter of 1964.

For comparative purposes, the head of each column in Table 1 includes parenthetically the allowable radioisotope concentration in a mill effluent according to the Regulation 10CFR20 of the Atomic Energy Commission.

It should be borne in mind that in interpreting the data, the limits for exposure of the general public are one-third of these figures. It must also be borne in mind that we are concerned with the mixture of isotopes present, and the parenthetical numbers represent the allowable concentrations in effluents, assuming the absence of significant quantities of other radioisotopes.

I think most of you are familiar with this, and I don't need to go into detail.

Finally, you should bear in mind that these 10CFR20 limits can be exceeded if the Atomic Energy Commission, upon receipt of adequate supporting evidence, grants a permit for this purpose. Some such permits have been issued by the AEC on an interim basis, and we have been kept informed as it has gone along.

Referring now to the figures in Table 1, I would like to emphasize that many of the numbers do not represent effluents to the water environment, but rather only potential releases, and these are tailings pond liquids not ordinarily released to a nearby stream.

With this in mind, let's look at the figures and see what they say.

The Grand Junction, Colorado, mill had, at the time of the survey, one effluent consisting of sewage and vanadium process waste liquors. As may be seen from the table, this effluent contained about six times the allowable 10CFR20 limit for Radium 226, but no isotope exceeded its specific limit. It has consisted of approximately 100 gallons per minute of flow, to the best of our knowledge.

E. C. Tsivoglou

It is our understanding that this effluent is soon to be placed in a seepage ponding area that presently receives other effluents. Seepage from the Grand Junction mill did not contain any isotopes in concentration that exceeded the 10CFR20 limit, and is not regarded as hazardous.

The Mexican Hat, Utah, mill of the Texas Zinc Corporation periodically pumps raffinate pond liquid to a canyon which enters the San Juan River. The flows are said to range from 75 to 275 gallons per minute, depending upon mill processing practice at the time.

As may be seen from the table, all of the radioisotopes measured exceeded the 10CFR20 limit, with the exception of uranium itself. Specifically, the average Radium 226 concentration was twelve times the limit; the average Lead 210 was about 60 times the corresponding limit; Polonium 210 about three times its limit; and Thorium 230 about 70 times its corresponding limit.

Now, when I say "average," let me caution you and refer again and emphasize, because I am talking of only two samples, one last summer and one in January, so we don't regard these figures as the last word in averaging techniques. However, they do provide a fair indication of the levels of radioactivity present.

E. C. Tsivoglou

We know very little about the potentiality for individual human exposure below Mexican Hat. We have doubts also as to how long some of these radioisotopes may remain dissolved in river water. We do know that the San Juan flows occasionally drop to rather low levels, and that the available dilution at times may be small. In view of the ability of other mills to consistently avoid such relatively large releases of radioactivity to surface waters, there seems to be no apparent reason why these releases from Mexican Hat should be necessary. We hope, therefore, that the releases can soon be eliminated or reduced considerably.

The effluents from the Moab, Utah, uranium mill in June of 1963 exceeded the Radium 226 limit by a factor of 35, and slightly exceeded the Lead 210 limit. This flow was about 1,100 gallons per minute. However, the January 1964 sample from this mill shows a very sharp reduction in isotope concentrations, as may be seen in the table. In fact, the reduction for a while led us to wonder if we could have gotten our samples mixed up, but, on checking, the January sample may not be fully representative, but it indicates valid reductions, I think, that are present.

This is due to improved waste treatment practices at the mill, namely, the precipitation of radium and apparently other isotopes with barium chloride, and subsequent settling in a pond before release to the river.

Effluents from the Rifle, Colorado, mill are two. The east weir effluent, we were told, averages about 7 gallons per minute, very small, and as may be seen from the table, it contains no isotope concentrations in excess of the 10CFR20 limits. The west weir effluent is understood to flow usually from 10 to 150 gallons per minute, and to average about 55 gallons per minute, although these are not firm flow figures at all. I understand that they may be a little higher than that.

In this case, the Radium 226 limit is exceeded by a factor of 4, the Polonium 210 10CFR20 limit is exceeded by a factor of 50 times and the Lead 210 limit is exceeded by a factor of about 500 times.

Even though dependable low flows in the Colorado River at Rifle provide substantial dilution, it appears highly desirable that the west weir effluent either be retained, or that the concentrations in particular of Lead 210 and Polonium 210 be sharply reduced to more acceptable levels.

Three seeps have been sampled at the Shiprock uranium mill of the Vanadium Corporation of America.

As may be seen from the table, with the exception of Radium 226, all of the isotope concentrations are far below the 10CFR20 limits. The average Radium 226 concentration was just about at the limit of 10 micromicrocuries per liter. This is not regarded as a significantly hazardous situation in view of the available dilution most of the year, compared to the actual radium concentration in the seeps. It will be followed, however, by regular sampling in order to assure that the situation becomes no worse.

The Uravan, Colorado, mill of the Union Carbide Nuclear Company presently has two direct effluents to the San Miguel River, as indicated in Table 1.

I might insert a comment here that some of these things have changed, but we think not substantially, during the period in which we have been collecting samples. These are the yellowcake effluent and the ion-exchange backwash effluent.

The only isotope concentration of significance in these two effluents is the 11 micromicrocuries per liter of radium in the yellowcake effluent. This consists of only about 15 gallons per minute, and by itself is not regarded as unduly hazardous.

The seepage from Hieroglyphic Canyon, as may be seen, does not contain significant quantities of any isotope. The Plant 5 effluent is now delivered to seepage ponds across the San Miguel River.

As may be seen, this material and the ferric vanadate pond liquid, which I understand may not occur any more, contain large quantities of Thorium 230 -- over 100 times the 10CFR20 limit. They are presently not discharged directly to the river, but the Thorium 230 levels themselves indicate the high degree of improvement that has been accomplished by the company in terms of retaining these wastes and delivery of the Plant 5 effluent to seepage ponds.

As you can also see from Table 1, several of the tailings pond liquids that are not usually discharged to surface water contain quite high concentrations of radioisotopes relative to the 10CFR20 limits. We will not discuss those at this time, except to indicate that they represent a substantial potential for stream pollution, and we hope that such pond contents will not be accidentally lost to surface waters, which makes it a good time to point out that for the first year since the inception of the Colorado River Project, to our knowledge, there have been no major accidental spills from uranium mill tailings ponds in the basin, and this represents an improvement from the past years.

As I noted above, the analytical work involved in obtaining these results has been a considerable burden partly unanticipated on our laboratory. Our budget for the work remains limited, and the amount of work that can be done in the coming year accordingly is also limited.

I would therefore like to review rather carefully some of the responsibilities of the parties concerned in order that we can properly develop the best possible means of cooperation of all concerned in the problem of adequately defining and properly controlling the mixture of radioisotopes that results from uranium milling operations.

The Atomic Energy Commission is responsible for regulating and limiting the amounts of radioactive wastes that a licensee releases to the environment. The specific rules have been published in the Federal Register as 10CFR20, and they include specific effluent concentration limits for each radioisotope. These are the limits referred to in Table 1. They may not be exceeded without specific permission from the Atomic Energy Commission.

Under the same rules, the Atomic Energy Commission will grant permission to exceed these limits if the licensee demonstrates satisfactorily that no individual will be exposed to radioactive concentrations, averaged over a year, that exceed the same limits. Thus, the 10CFR20 limits can be in effect point-of-use standards. Each individual limit is predicated on the assumption that no other radioisotope affecting the same body organ is present in significant concentration. If two or more isotopes are present, the rule for mixtures effectively reduces the limits for each.

A small number of permits to exceed the 10CFR20 limits have been issued on an interim basis during the past two years or so by the Atomic Energy Commission. They have involved the prevailing mixture of Radium 226, Thorium 230, and uranium, but not Lead 210 or Polonium 210, because, until now, we have had available no adequate or firm information regarding existing concentrations of these isotopes. As I pointed out, we have had essentially no valid analytical data.

The specific industry responsibilities to the Atomic Energy Commission are clear from the above. Under the rules of 10CFR20, the industry is required to keep radioactivity concentrations in its effluents to surface waters below the 10CFR20 limits, and if a mixture is involved, the rule for mixtures reduces those limits.

Alternatively, the company may request of the Atomic Energy Commission a permit to exceed the 10CFR20 limits by specified factors. In that event, the company must demonstrate to the Atomic Energy Commission's satisfaction that no individual will be exposed to concentrations exceeding the 10CFR20 limits averaged over a year. The same rule for mixtures applies.

It is the policy of our Division to keep surface waters as clean as possible. This is regarded as especially important in the case of radioactive wastes, for which a principle of minimum exposure applies, and it is our policy to comply with and implement the philosophy of the Federal Radiation Council, which has been stated as follows:

> "There can be no single permissible or acceptable level of exposure without regard to the reason for permitting the exposure. It should be general practice to reduce exposure to radiation, and positive effort should be carried out to fulfill the sense of these recommendations. It is basic that exposure to radiation should result from a real determination of its necessity."

Thus, in determining whether existing levels of radioactive water pollution are "necessary" or should be reduced, the two criteria of technical feasibility and reasonableness of cost must be evaluated, and it is apparent that pollution abatement measures that are both feasible and reasonable should be carried out.

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Of course, these criteria apply to radioactive pollution below the accepted limits for human exposure, and the cost of abatement is not regarded as an important factor at all in cases where such limits are exceeded.

As regards uranium milling liquid wastes, we know from experience that certain pollution abatement measures are technically feasible. The collection and retention of tailings or spent ore solids has also proved reasonable in cost, and our earlier problems of river sediment contamination with mill tailings have been essentially eliminated. Treatment measures to reduce the releases of dissolved radioactivity are also feasible, and, by the example of some of the mills, have proved also to be reasonable in cost. These measures include the retention and recycling of liquid effluents, neutralization and subsequent sedimentation, the use of barium compounds as aids to precipitation, and the use of seepage ponds for soil percolation and ion exchange.

The data of Table 1 indicate clearly that in all except two cases the industry has found it both feasible and reasonable to reduce and control its radioactive effluents. In these two cases, it should be carefully noted that Radium 226 is the least important contaminant, and that, because suitable analytical methods have not been available, the industry itself, as well as the Atomic Energy Commission and the Public Health Service and the States, have not been aware of the actual concentrations of Lead 210 and Polonium 210 that are present. The project has had to develop these tools in order to try to define the problem. These laboratory techniques are now, of course, available to anybody upon request to the project.

To the best of our knowledge, the Lead 210, Polonium 210 and Thorium 230 concentrations in the mill effluents have not resulted in excessive radiation exposure to people.

We have only obtained these data regarding Lead 210 and Polonium 210 in the last two weeks, and have not had time to develop firm estimates regarding radiation exposure. However, we have enough data to do so.

Rough computations based upon available dilutions indicate that excessive radiation exposure is not likely. The small monitoring network result for Lead 210 and Thorium 230 contain a relatively high result, but not exceeding an allowable limit. However, we have not had information regarding the exposure to individuals, nor do we know whether one or more of the isotopes involved remains dissolved or precipitates to the riverbed when the effluent mixes with the river water.

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We have not had time to evaluate these effluents adequately in terms of river hydrology or the presence of fallout of radioisotopes.

It must be emphasized again too that the data represent only two effluent samples taken roughly six months apart. Thus, we are not sure at this time whether true average concentrations of the two effluent flows. However, our best guess is that these things are not resulting in excessive exposure.

We do hope that in view of the new information, and particularly regarding Lead 210 and Polonium 210, these two companies can proceed with measures to reduce the effluent radioactivity concentrations to the low levels that are now customary at other uranium mills in the basin. This would also be more in keeping with the 10CFR20 limit and with the philosophy of all of the Federal agencies, as stated by the Federal Radiation Council.

The project will continue within its budget to provide all possible technical assistance in the form of analytical methods development, effluent and stream monitoring, laboratory analysis and whatever else it can do.

I would like to touch now briefly on the business of abandoned mill tailings. We have not progressed as far as we had hoped last year, but we have some information to give you.

As you know, the studies were begun last year to evaluate the quantities of various radioisotopes present in the abandoned tailings in the basin. The purpose of the studies is to determine the amounts of radioactivity present, to estimate, as well as possible, their potential effect in terms of water pollution, and to judge whether remedial measures are necessary or desirable in any case. Evaluations are not yet complete, but we have considerable data.

Similar studies have been made by the Atomic Energy Commission, and we may have some report of their work later today from their representative.

Project personnel surveyed and sampled the uranium tailing ponds at seven uranium mills last summer. These surveys included field estimates as well as sampling in a number of locations to obtain representative samples for assay. The project laboratory assayed all of the samples for Radium 226, thorium and uranium, as well as other physical features. Analysis for Lead 210 and Polonium 210 was not possible because of other more pressing laboratory work, such as the assay of mill effluents.

It may be possible during this coming year, at least, for a small number of composite samples to provide Lead 210 and Polonium 210 results as well.

The results of the work are given in Tables 1 and 2. Do you have those?

MR. KLASHMAN: No, we don't have those.

DR. TSIVOGLOU: You don't have them? All right. Well, I don't think you need them. I can discuss them very briefly.

To summarize, the average Radium 226 concentrations ranged from 140 to 990 micromicrocuries per gram. Thorium ranged from 40 to 920 micromicrocuries per gram. Radium ranged between 40 and 310 micromicrocuries per gram, or between about 0.006 and 0.047 percent. No tailings pile contained more than 0.05 percent uranium on the average.

A total of some 3,300,000 tons of tailings remain at seven closed mills by field estimate. This is about 80 percent of the recorded number of tons of ore processed by the seven mills. The latter information was given to us by the Atomic Energy Commission.

These abandoned tailings contain about 1,900 curies of Radium 226, about 1,400 curies of thorium, and about 850 tons of uranium.

During the year, project personnel have met twice with representatives of the Atomic Energy Commission, first to discuss plans for the necessary field surveys as well as potential effects of the tailings; later to discuss briefly survey results. Exchanges of survey data have been made in correspondence.

At the request of the Atomic Energy Commission, an opinion was prepared regarding potential water pollution hazards associated with the abandoned tailings pile at Hite, Utah, as this tailings pile will become submerged by Lake Powell once **Glen** Canyon Dam Reservoir is built.

During our 1963 survey of the Hite tailings, ten representative samples were taken. Three of them contained uranium considerably in excess of 0.05 percent. Samples taken by the Atomic Energy Commission were similar, and since that time, the Vanadium Corporation of America has removed much of the high uranium tailings and recovered the uranium.

The remaining tailings are estimated to total only about 20,000 tons, or less than one percent of the tonnage of the seven closed mills. They contain less than one-half of one percent of the total amount of radioactivity remaining in the seven closed mills. The area is highly isolated.

Based upon these facts, the opinion is given that there is no significant likelihood of any future radioactivity water quality problem resulting from the presence of the tailings on the bottom of Lake Powell. It was estimated that there should be no detectable increase of the radioactivity of the water of Lake Powell due to the high tailings.

The problem of evaluating potential effects is not so simple at some of the other closed mills, unfortunately, including such locations as Naturita, Durango and Rifle, Colorado. These locations are not highly isolated. The abandoned tailings piles are located near the river and they contain relatively large quantities of radioactivity, as we have established. One of these piles is located in a substantial population center on a heavily used stream. Another at Naturita is partly exposed to the annual floods of the San Miguel River.

In such cases, it will be necessary during the coming year to evaluate more closely the potential for significant quantities of tailings which wash into the river, and the associated degree of water contamination that might result in terms of the isotopes involved.

Our monitoring network shows some increase in dissolved Radium 226 concentrations in the San Miguel below the Naturita tailings area, for instance, although by itself the observed increase does not create a significant hazard. I think below Naturita they show a radium concentration about six or eight times the natural background level.

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These data have not been correlated with hydrologic information yet and we'll have to measure the concentration of other isotopes, as well as radium.

To the best of our knowledge, the Atomic Energy Commission has not determined as yet whether it has jurisdiction over the abandoned tailings when their average uranium content is less than .05 percent. Possibly the Atomic Energy Commission representative will touch on this point also later today.

As noted above, we plan during the coming year to evaluate more closely the potential for stream contamination from abandoned tailings at several locations, and will report on these evaluations as soon as they can be made.

In the meanwhile, we hope that where large quantities of tailings are located at the edges of important streams, the companies may investigate the technical feasibility and cost of measures to protect the streams adequately.

Depending upon local site circumstances, such measures might include the removal of some of the tailings, adjustments of base slopes, and grassing or otherwise treating the surface, removal from flooding areas, the protection of the tailings pile against erosion, or other measures.

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The possibility of using tailings as subgrade material for highway construction continues to be mentioned as a possibility, and properly evaluated and controlled may prove to be a feasible means of adequate confinement in some cases.

That is all we have to report.

Table 1

Average Liquid Wastes Radioactivity Content

(1963 - 1964)

	$\mu\mu c/l.$				
	Ra^{226}	Pb^{210}	Po^{210}	Th^{α}	U*
(10CFR20)	(10)	(100)	(700)	(2,000)	(20,000)
Mill and Waste					
1. Grand Junction, Colo.					
Vandadium Proc. Effluent	63	70	55	0	220
Tailings Pond Liquid	120	-	0	38	2
Seepage Pond Liquid	220	-	9	14	0
Seeps	-4	11	1	5	150
2. Maybell, Colo.					
Tailings Pond Liquid	79	1290	1080	43,000	24,000
No. 3 Pond Liquid	63	1460	1190	43,000	12,000
Tailings Pond Seepage	19	34	3	30	1800
3. Mexican Hat, Utah					
Raffinate Pond Liquid (at effluent pump)	120	5900	2100	140,000	4000
Gypsum wash seepage	5.0	5	6	10	1400

Table 1 (continued)

	μμc/1.				
	Ra^{226} (10)	Pb^{210} (100)	Po^{210} (700)	Thα (2,000)	U* (20,000)
4. Moab, Utah					
Holding pond effluent June '63	350	140	70	30	3900
January '64	1.0	6	1	14	3900
5. Rifle, Colorado					
East weir effluent	7	14	1.8	6	110
West weir effluent	36	55,000	28,000	900	1100
6. Shiprock, New Mexico					
Ave. of 3 seeps (not acc. to flow)	11	12	1.5	13	800
Raffinate pond liquid	250	5400	2800	710	120
7. Tuba City, Arizona					
Tailings pond liquid	270	150	67	157	73,000
8. Uravan, Colorado					
Yellowcake effluent	11	7	2	16	1000
Plant 5 effluent (now to pond)	13	27	14	204,000	1900
Ion-exchange backwash effluent	<1	4	0	38	2200
Ferric vanadate pond liquid	18	82	45	280,000	2700
Hieroglyphic Canyon seepage	2	4	1	4	150

* U-natural - Uraniums are given as μμc/l, based on the factor, $\frac{2}{3}$ x μg/l = μμc/l

MR. STEIN: Thank you. Are there any comments or questions?

MR. THATCHER: Could I raise a question?

MR. STEIN: Mr. Thatcher.

MR. THATCHER: Dr. Tsivoglou didn't touch on this directly.

Last year Mr. Williamson indicated some toxicity from very low levels of uranium, below one part per million. Has any work been done on this at the Center, or by your group, Dr. Tsivoglou?

DR. TSIVOGLOU: No. Not to my knowledge. Not on the toxicity of uranium itself. I believe nothing has been done.

Should I be corrected? Charlie?

MR. THATCHER: I am wondering if perhaps this wouldn't be worth investigating, not that I dispute the statement that was made last year, but I think if this is true we should have more information on it.

DR. TSIVOGLOU: I will climb out on a limb. I am inclined to guess that it will not prove to be so simple a matter of evaluation. I am inclined to suspect that you are requesting the project to undertake a fair piece of research.

MR. WILLIAMSON: To bring you up to date on what information we had, which our Game and Fish Department worked on several years back, 600 parts per billion produced very toxic effects in a small pond area, which was a fishing pond. They reduced it to 150, and the fish were all right.

I mean, somewhere in this limit is what you are talking of.

DR. TSIVOGLOU: What is bothering me, though, is, was uranium the only thing present?

MR. WILLIAMSON: Yes.

DR. TSIVOGLOU: For example, if this was a highly acid effluent or content, that I think would influence the results quite a bit.

MR. WILLIAMSON: This was natural springs.

DR. TSIVOGLOU: Oh?

MR. WILLIAMSON: Containing 600 parts per billion. It was impounded and the fish didn't grow and died. Then they treated the spring water and produced this fish.

DR. TSIVOGLOU: I think the proper answer then is that the project should look into the data and see what further it ought to do.

MR. CALDWELL: Mr. Chairman?

MR. STEIN: Yes.

MR. CALDWELL: I mentioned to you this morning our concern about tailings piles, and for the sake of the record I would like to read this paragraph which comes out of a recent publication.

> "Accordingly, the transfer and subsequent use of tailings which contain by weight less than 5/100 percent uranium, thorium, or any combination thereof, are not subject to the AEC licensing requirements."

The way I understand that, that leaves it wide open to use it for most anything.

DR. TSIVOGLOU: I am not sure. There is an AEC representative here, and he may want to comment.

My understanding so far is that it isn't necessarily as clear and simple as all that.

We have discussed this with some of the AEC people in Washington. I think they still have questions as to just how far their jurisdiction extends. Would you like -- this would be, I think, a time to interrupt me or discuss this with Mr. Harmon.

MR. HARMON: I am Tom Harmon.

Under the circumstances of that particular letter, if I in fact recall correctly, the E.T.A. requested the use of the tailings, and that was the answer to their question. The overall answer to the control of tailings has not been decided, as far as I know.

MR. CALDWELL: Was it decided on these tailings?

MR. HARMON: I assume my comments later on will clear it up.

MR. CALDWELL: All right.

MR. STEIN: Mr. Marx?

MR. MARX: Maybe I didn't get this in the beginning, but how far down the mainstem of the Colorado have these isotopes or the results of uranium been found to have penetrated? That is, not only in dilution, but in the mud and sediment?

DR. TSIVOGLOU: I hate to say. We know that they proceed in the immediate areas where they are released. When we get down into the great lakes of the lower basin, we have some indication of very slightly increased Radium 226 levels, for instance, but we are so close to the limits of detectability by our methods, and there are so many factors that may influence a slight gain or a drop in Radium 226 that is dissolved in water, that I would hesitate to say anything more.

MR. MARX: I have another question, and that is, on these abandoned tailings, how well engineered are the containments against massive erosion into the tributaries of the Upper Colorado River, that call for flooding, etc., etc.?

DR. TSIVOGLOU: I would hate to try to put into words my impressions.

I think some of them are unlikely to have massive erosion, several of them -- a number of them. As I said, one of them is in the flood plain of the river, and I think every spring there is some erosion. Mostly, though, that is --

MR. MARX: You don't feel that is significant?

DR. TSIVOGLOU: That is an exceptional case. Not by itself -- not by itself, but we have sources of pollution throughout the basin, and what we have to do is to look at the hydrologic data, try to put these things together, try to consider all of the sources instead of one and see what it amounts to then.

MR. MARX: Have you answered the other question about how well engineered the containments are?

DR. TSIVOGLOU: I hope I finished.

MR. CALDWELL: Would it be appropriate for the project to work with the AEC to determine something more definite on what can be done to contain or remove these pilings?

DR. TSIVOGLOU: Of the tailings pilings?

MR. CALDWELL: Yes.

DR. TSIVOGLOU: The project has been working with the AEC during the past year. As I tried to indicate, without question the two agencies will continue to work together to try to come to reasonable conclusions as to what can and should be done.

MR. CALDWELL: Sometime this year, probably?

DR. TSIVOGLOU: I would hope so. Yes.

MR. MARX: How many of these mills are still in operation?

DR. TSIVOGLOU: Well, there are seven closed mills, and I think the table of effluents I gave you will give the number of mills still active in the basin, that is.

MR. STEIN: Are there any further questions or comments?

(No response.)

MR. STEIN: I don't know that I have any questions or comments, but just for clarification, one of these was this question of uranium damage to fish, which you didn't seem to get at.

DR. TSIVOGLOU: Which I evaded. Yes.

MR. STEIN: Yes. I assume that if this is a problem, and it seems to be a problem, it doesn't seem to me that on the ponds indicated by Mr. Williamson that this should be too difficult to detect and measure.

DR. TSIVOGLOU: No, sir. I am not sure -- I get all mixed up between concentrations in radioactivity and concentrations in grams or parts per billion, and I hesitate to try to do the computations in my head here.

Surely, we should look into it, as Mr. Williamson suggested.

MR. STEIN: Right. If uranium is coming out in such forms as you may not think are a hazard to health, from a radioactive standpoint, and yet, from a toxic point or any other point are injurious to fish in these concentrations, I think this is a question that should be answered.

As I understand this, if we are going to do this kind of work for the project, we will have to get biologists from Cincinnati to help us on it. Is that correct?

MR. KLASHMAN: That is correct.

MR. STEIN: All right. That is one.

The second point is, and I think I can sympathize with Mr. Caldwell, that ever since I have been here, at least with this problem -- and this is the fourth or fifth conference -- we have been concerned with uranium pilings.

I think we should come to some conclusion as to whether these pilings are dangerous, whether they are not dangerous, whether they are eroding, and specifically what is going on. Again, this doesn't seem to me to be a particularly exotic operation, at least not exotic enough to defy answer for five years by two agencies such as the Public Health Service and the Atomic Energy Commission.

Here we still have the Naturita, Durango and Rifle tailings that you indicate very well may have to be watched during the next year rather closely. You also raised several questions on these tailings ponds, and I don't know that I can put my finger on it, whether they will erode, whether the tailing ponds are confined --

DR. TSIVOGLOU: These were possibilities for confinement.

MR. STEIN: I understand these are possibilities.

DR. TSIVOGLOU: Yes.

MR. STEIN: But it seems to me that where something is amenable to an engineering solution, to either take it away, shore it up or grass it up, that we should be able to get some answers to that problem. I don't know that they shouldn't be forthcoming certainly in the near future.

DR. TSIVOGLOU: I would think so.

MR. STEIN: I really don't think we should go through another meeting like this and not come up with a definitive report on each tailing pond in the basin, whether it is satisfactorily contained and it is safe, or whether work has to be done.

DR. TSIVOGLOU: I think this is the --

MR. MARX: Murray, we are so concerned about burial and disposing of radioactive wastes, and yet here we have these big tailings out there that nothing really definite has been done about. This is what I am concerned about, and this brings us right back to 1960, when we first became interested in this thing because of the radioactive wastes going into the Colorado River.

MR. STEIN: I certainly agree with you. The conferees may want to consider this in their recommendations.

MR. MARX: I think something permanent should be done about this.

MR. STEIN: I would suggest if we don't have a permanent solution or a solution satisfactory to the project and the Atomic Energy Commission on each tailing pond, then a report with a recommendation should be made about each tailing pond that isn't considered to be satisfactory, and we will see where we will go from there.

DR. TSIVOGLOU: I think this can be done.

MR. STEIN: Mr. Thatcher?

MR. THATCHER: May we assume also, from what Dr. Tsivoglou said before, that this will include some determination of lead and polonium?

DR. TSIVOGLOU: Yes, but, you see, there we go. Now, that will probably be a while before we get them.

I am not about to indicate that the laboratory will produce lead and poloniums on these abandoned tailings within the next couple of months, because I know a little bit that is involved.

MR. THATCHER: But apparently, from what you said, this could be a new dimension in this thing that certainly needs to be investigated before we come to final conclusions.

DR. TSIVOGLOU: Well, what I have implied right along, I think, is that to determine the degree of hazard associated with these tailings piles is no simple problem.

If you think in terms of immediate hazards and in terms of hazard this year, it is very difficult to show that there is a problem.

What has concerned us right along has been the long-lived nature of the radioactivity involved.

MR. MARX: That's right.

DR. TSIVOGLOU: Somehow, we have to resolve the question of what kind of a hazard, what degree of hazard this amounts to, and what kind of position is justified for us to take. This is not quite so simple.

MR. STEIN: You know, Dr. Tsivoglou, I am not sure I understand this. I am not sure I quite understand that.

Anyone who puts up a tailing pile, which is a mound of material, that contains radioactive material, whether it is radium, thorium or polonium, it seems to me has an obligation, in the same sense as you put in the law as an insurer, that he has to keep that outflow from a short-range and a long-range point of view.

It doesn't seem to me that anyone can go around a river basin and set up a series of piles of debris, which might have long-lived effects, and just go away and abandon those piles, and come back year after year without a definitive answer on it. I really do think we have to resolve this situation.

DR. TSIVOGLOU: Well, I think the project can tell you within a short time what could be done, and then I think it will have to be taken from there by a group, not the project by itself.

MR. STEIN: May I suggest that this report be made as soon as you can, and try to get it to the Technical Committee, so that we can determine this, and not wait until next year, because I think it would be disgraceful if we were to let another year go by and still have this problem hanging over us.

MR. MARX: I have another question.

MR. STEIN: Yes, Mr. Marx.

MR. MARX: Ernie, as I remember, there are certain isotopes that are bone-seekers. I am getting back to fish now.

DR. TSIVOGLOU: Yes.

MR. MARX: How about these other isotopes that have been showing up recently?

DR. TSIVOGLOU: Some of them are bone-seekers, but, to be more precise, all of them will go to the bone to some degree or other. For some of them, the bone is not the critical organ. That is, they will go preferentially to some other organ, but, to some degree also, will radiate to the bone, so that what we have is a whole series of numbers for each isotope, depending on which body organ we choose to look at.

MR. MARX: So we still have this problem of sport fishing?

DR. TSIVOGLOU: You have a problem of mixtures of isotopes.

MR. STEIN: You know, I would like to emphasize to the people here what we are doing is really cleaning up just a few spare ends.

I think the problem of radioactive pollution has been controlled in the basin, and remarkably so. I think the industry and everyone is to be commended.

It is only when you get a clean-up of this magnitude and you are dealing with something like radioactive materials where you are striving for a hundred percent perfection, that we get down to this. I would like this to be in perspective so that no one will misunderstand that.

I have one other point that you mentioned, Dr. Tsivoglou. You talked about the pond contents, saying they represented a substantial potential for stream pollution, and it is hoped that such pond contents will not inadvertently or accidentally be released to surface waters.

As I understand it, at least for two years we have been working on improved criteria for ponds. Are these in effect, and, if they are in effect, have the structures been improved?

DR. TSIVOGLOU: I think last year we announced that -- either at last year's session or shortly after, we indicated that the construction criteria had been finished and had been distributed.

MR. STEIN: Have they --

DR. TSIVOGLOU: I think there is a joint document from both Federal agencies.

However, there was a problem -- I think we indicated it -- that the construction criteria primarily have to apply to new tailings piles rather than to old ones.

What was not proposed at that time was to reconstruct all the tailings piles.

I believe, in answer to your question, that some of the tailings piles have been improved considerably. I think we were told last year that at Moab, for instance, riprap was used to reinforce the tailings ponds and to prevent accidents, and I believe similar measures have been taken at some other mills.

MR. STEIN: Well, here again, this is what in a sense disturbs me. It says that it is to be hoped that such contents will not inadvertently or accidentally be released to surface waters.

Here are people sitting in the basin with a bunch of these ponds. Don't you think you could have more than a hope?

DR. TSIVOGLOU: It is not my job, I think, to issue orders.

MR. STEIN: No, I am not saying it is your job to issue orders.

DR. TSIVOGLOU: I think that is the conferees' job.

MR. STEIN: Again, I would suggest this. I am talking about good housekeeping in the record, and recognizing the advances made again, but I think we should not say that we hope that this is going to happen or, "I hope we won't have an accident or release." However, if this is any kind of problem, we may need a pond-by-pond inventory on this to indicate what the chances are, unless you feel that there is no problem.

DR. TSIVOGLOU: Well, as I pointed out, I think we have had no accidents in the basin during the past year. I think this is the first year that has happened, so that we have a considerable improvement over prior years.

I think that the project's position is to advise the conferees. I think what I have said is appropriate. The project hopes that we won't have accidents. I think the conferees will have to take it from there.

MR. STEIN: Do you think we have to do any more about the ponds, or the conferees should rest on the hope for next year?

DR. TSIVOGLOU: Not any particular, no.

MR. STEIN: What do you suggest can be done to improve the hope about these ponds?

DR. TSIVOGLOU: Well, I suppose what I suggest is that largely the companies watch their pond contents, watch their tailings walls, and see that they don't have accidents. This is what I hope.

I think the project has expressed itself reasonably well on what it thinks would be advisable. I think the conferees have to take it from here, Murray.

MR. STEIN: All right. Let me raise one more point.

You indicate that there are two mills, one the Rifle, Colorado, mill of the Union Carbide Nuclear Company, and the Mexican Hat mill of the Texas Zinc Corporation. Is that right?

DR. TSIVOGLOU: Yes.

MR. STEIN: Which you believe can reduce their effluents and improve stream conditions?

DR. TSIVOGLOU: I don't think that is Texas Zinc any more, but I am not sure. I think the company has changed.

MR. STEIN: Well, anyway, the Mexican Hat, Utah, mill?

DR. TSIVOGLOU: Right.

MR. STEIN: What do you suggest?

DR. TSIVOGLOU: I believe that these wastes can be reduced, and I believe that they should be reduced.

MR. STEIN: How do you suggest that that be done?

DR. TSIVOGLOU: I don't suggest the method. I think that the --

MR. STEIN: No, I am not talking about the method of the mill reducing it. I am asking what do you suggest should be the procedure for the conferees? Will you get together with AEC and the mills?

DR. TSIVOGLOU: Yes.

MR. STEIN: And come up with a remedial program and see what can be done?

DR. TSIVOGLOU: Yes. I think that will certainly be the first step.

I would like to emphasize the analytical data that I have presented are brand-new, and that nobody has had this information available. We got the bulk of these results in the last two or three weeks, so that I think there is no question of blame to be attached anywhere, or anything like that.

MR. STEIN: No. Again --

DR. TSIVOGLOU: I think it indicates a problem that we all should get together and try to solve.

MR. STEIN: Again, I should like to point this out: I think that the uranium milling industry in the pollution control field has been as cooperative as any industry that I know of in the country. This isn't a question of lack of will or cooperation from the industry. As a matter of fact, I think they have a pollution control record which can well stand as a model for most other American industries. They have done a magnificent job.

Again, I think this is just a situation where, because you are dealing with a radioactive substance and we do have substantial control, that we are really refining the situation here and trying to get the best possible thing we can.

Are there any further questions?

MR. CALDWELL: I have one question I would like to ask.

Some of these mills are closing down, and, of course, they are leaving these big evaporation ponds behind them, and the water is evaporating and leaving concentrated wastes.

Do you see any problem there, Ernie?

DR. TSIVOGLOU: If I heard you correctly, I don't think so, but I am not sure I heard you properly.

You were concerned about the evaporation and concentration of wastes in the tailings ponds?

MR. CALDWELL: Not in the tailings --

DR. TSIVOGLOU: I don't think any more than might be associated with a tailings pile.

MR. CALDWELL: I see. What I am thinking about is something --

DR. TSIVOGLOU: And that depends on the individual circumstances. There can't be a general statement for all mills.

MR. CALDWELL: What I am thinking about is some of our mills around Ambrosia Lake have these big extensive ponds, and they are curtailing their operations. I was wondering about those ponds after they leave.

DR. TSIVOGLOU: I don't think we have seen a sign of large or, let us say, high levels of contamination in ground waters yet down there, but I am not familiar with all of the data you have.

MR. CALDWELL: Thank you.

MR. STEIN: Thank you.

Are there any further comments or questions?

(No response.)

MR. STEIN: If not, thank you very much, Dr. Tsivoglou.

DR. TSIVOGLOU: Thank you.

MR. STEIN: Mr. Klashman?

MR. KLASHMAN: I would now like to call on Mr. Don Harmon of the Atomic Energy Commission.

STATEMENT OF DON F. HARMON, RADIATION SAFETY SPECIALIST, UNITED STATES ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.

MR. HARMON: I am Don Harmon and I am with the Source and Special Nuclear Materials Branch of the Division of Materials Licensing of the United States Atomic Energy Commission.

INTRODUCTION

We appreciate the opportunity to participate in the Fifth Session of the Conference on the Interstate Pollution of the Colorado River and its Tributaries. The Atomic Energy Commission's primary interest in this conference stems from its regulatory responsibilities in connection with uranium milling, including the discharge by uranium mills of liquid effluents containing low concentrations of radioactivity into the Colorado River and its tributaries. We have described at previous sessions of the conference the various elements of our regulatory program with respect to the uranium mills.

D. F. Harmon

CLOSED MILLS

Recently several uranium mills have ceased operations as a result of changes in the Commission's uranium procurement program and depletion of uranium ore bodies in some areas. As we advised the interested parties in November 1963, the closing of uranium mills has raised questions as to whether control for radiological safety purposes of tailings at closed uranium mills is within the Commission's regulatory jurisdiction, and, if so, whether there is a need for the adoption of requirements for further control of these tailings.

We have initiated preliminary survey programs to obtain data which will assist in the determination of these questions. The purpose of these surveys is to obtain information as to the isotopic content and concentrations of radionuclides in the tailings piles and the concentrations of airborne radioactivity produced by wind action on tailings piles. We expect the sample results from these surveys to be available for evaluation within the next few months. By letter dated November 14, 1963, we informed the State conferees, the Public Health Service, State health agencies and the uranium mill licensees of the steps being taken to deal with this matter.

D. F. Harmon

Lead 210

At the last conference session the possible significance of Lead 210 in uranium mill effluents was mentioned. Prior consideration of the characteristics of the radioisotopes in the natural uranium decay chain indicated that the radioisotopes in uranium mill effluents of significance from a radiological safety standpoint appeared to be Radium 226, Thorium 230 and natural uranium. However, because of the interest expressed at the last session, we are looking into the Lead 210 question. Our Division of Compliance has obtained several samples of mill effluents and river water for Lead 210 and Polonium 210 analysis. In connection with analysis of the samples, we are doing necessary work to develop a reliable analytical method for these radionuclides.

We were informally advised by the Public Health Service on May 20, 1964, of data they obtained with respect to Lead 210, Polonium 210, and other radioisotopes, from limited effluent sampling at two uranium mills. However, the information provided us was not sufficient to permit evaluation of its significance.

Further study of this matter will be made as the sample data become available.

Thank you.

MR. STEIN: Thank you.

Are there any comments or questions at this time?

MR. HARMON: Let me say one other thing, Mr. Stein.

You brought up the matter of the structural integrity of the tailings piles.

MR. STEIN: Yes.

MR. HARMON: I think you reported in the last session that we had developed a guide in cooperation with the Public Health Service in structural integrity of tailings retention systems.

MR. STEIN: That is ponds. Right?

MR. HARMON: Well --

MR. STEIN: Is that correct?

MR. HARMON: Well --

MR. STEIN: If that is in error, let me know. I thought your structural integrity dealt with lagoons and ponds.

MR. HARMON: That is true.

MR. STEIN: Not piles.

MR. HARMON: Well, we tried to cover the whole gamut in the same guide.

MR. STEIN: Yes.

MR. HARMON: But I think about May of last year, we sent the guide out for public comments to all interested parties.

We received comments. None of them appeared to be too major. We revised the guide and it is in final form. We have been using it for at least the past year in our review of license applications for the license renewals. In this regard we have a structural engineer back at Washington who takes a very careful look at the structural integrity of all the tailings systems and the ability of a tailings system to retain the liquid, the raffinate that we were discussing.

I think we have been giving this pretty careful consideration during the last year, and, as a result, some significant improvements, I might add, have been made in the structural integrity of several of the tailings systems.

MR. STEIN: Mr. Marx?

MR. MARX: Does that include the seven mills that have shut down and that are still there? Is the guide applicable to those? This guide is in operation now, but how about the mills that have shut down?

MR. HARMON: If the mill is shut down, normally the liquid evaporates and you don't have anything to hold there.

MR. MARX: Yes, you do. You have all the radioactive waste there.

MR. HARMON: You have solid tailings.

MR. MARX: You have wastes that will go into solution the minute they hit water.

MR. STEIN: This is the problem we have.

MR. MARX: Surely. The minute they get into the stream, you are radioactive again.

MR. STEIN: I think this is the one problem we have to face, and I don't think it is going to go away.

The problem is this: As Dr. Tsivoglou pointed out, an abandoned pond probably has the same potential for damage as an abandoned pile. If you go away and you leave something, whether it is a pond or a pile, full of radioactive material, there is also the situation where these people living in the downstream areas in the downstream States are going to wonder what is happening to that pile.

Now, I would like to make this comment to get the answer. You talk about jurisdiction. I don't know if you are aware, or many of the people are aware, that we have, back in the East, what is popularly called acid mine drainage or coal mine drainage. Here we have thousands and thousands of abandoned coal mines with sulfuric acid pouring out of them every day in the year, and our problem is we can't find anyone who is responsible.

Now, for these people in the water pollution control field, they don't feel that they would like to be left with a legacy of a bunch of piles or abandoned ponds containing radioactive material, however small, where no one is going to be responsible if something happens, and the stuff is going to leak again into the stream.

MR. HARMON: Mr. Stein, I will say this --

MR. STEIN: Yes?

MR. HARMON: As I indicated before, this regulatory jurisdiction is under study at the present time.

Now, regardless of the situation, you have to have authority before you can do something, so I don't know how this question of jurisdiction will go, one way or the other.

MR. STEIN: I didn't push that. I just made this comment and I would --

MR. HARMON: I can appreciate your position, but at the present time I am not prepared to answer it.

MR. STEIN: I know. That is why it wasn't a question; it was a comment. However, I think the difficulty we get into, and we have gotten into this in the past, is if we ever get into a situation with a broad area of actual or potential pollution sources, with no one having jurisdiction over those sources, that is when we are plagued with some of our most vexing pollution problems. They just can't be cleaned up.

This is what I would suggest, if at all possible, we would like to avoid.

MR. HARMON: As I indicated in the statement here, we instituted this preliminary survey program to give us some guidance as to what these problems are that you are indicating, and what the extent of these problems might be, or whether there is a problem or not.

In connection with this survey program, we hope to come to some definite conclusion in the near future.

MR. STEIN: Are there any further questions or comments?

MR. MARX: The only thing I want to say, Mr. Chairman, is that we still have a problem in this area, after this discussion.

MR. STEIN: That's right.

Mr. Harmon, let me be very blunt about this. I think with an abandoned mine, where something is coming out, or a tailing or a pond where you have radioactive waste in it, I don't think that you can talk about whether you have a problem or not.

The question that the people in the area want to know is, are you going to prevent anything from coming out of it.

This business of running this through in slow motion to see whether you really have a problem, or if it isn't uranium it is polonium or thorium, where your tests take you six times as long to run as you would a radium sample, and you have to have years for the tests -- to run that by in slow motion does not make these people, as you heard Mr. Marx and Mr. Caldwell, sitting down in the downstream States, any less apprehensive, while it takes time to spin this out, and the mills close and the owners go away. They disappear from history.

MR. HARMON: I don't think that you really mean that.

MR. STEIN: Yes, I do. I rarely say something I don't mean. I mean it.

MR. HARMON: First of all, someone always has some control of the land to say it is their own, and accordingly is responsible.

MR. STEIN: Mr. Harmon, I don't know what to tell you now. I would suggest again, if this were true, we would not have that mine drainage problem in the East.

MR. HARMON: Of course, I am not associated with the mine drainage problem at all.

MR. STEIN: Don't say someone always has control over the land. You get a situation where back taxes are piled up, where the land is so bad or is arid or in a mountain, where the State does not assume control or pick up the land from back taxes. The owner who has defaulted the back taxes is long gone, or the corporation is long dissolved, defunct or bankrupt.

I think this notion of your being able to put a finger on the responsible party for each inch of land in this country is not born out by our experience.

MR. HARMON: Well, first of all, the Atomic Energy Commission has not relinquished control over these tailings piles at the present time -- don't misunderstand that -- and, secondly, I am not a lawyer and I can't argue the regulatory control aspect with you. I can merely talk about the technical aspects.

However, I think the primary object is, first of all, to determine whether or not there is a hazard associated with this sort of thing. That is my opinion.

MR. STEIN: All right.

MR. HARMON: That is my personal opinion.

MR. STEIN: Thank you.

MR. HARMON: You are welcome. Thank you.

MR. KLASHMAN: I would now like to call on Mr. William Davoren of the Department of the Interior.

Mr. Davoren.

STATEMENT OF WILLIAM T. DAVOREN, REGIONAL COORDINATOR, PACIFIC SOUTHWEST REGION, UNITED STATES DEPARTMENT OF THE INTERIOR, 125 SOUTH STATE STREET, ROOM 2209, SALT LAKE CITY, UTAH

MR. DAVOREN: Mr. Chairman, conferees and guests:

My name is William T. Davoren, Regional Coordinator for the Department of the Interior, Pacific Southwest Region, out of Salt Lake City, Utah.

I am co-representative of the Department today with Mr. Maurice Langley of the Bureau of Reclamation, Washington.

We are pleased to cooperate with this conference, as we are pleased to cooperate in other efforts of this type. I am thinking particularly of the water quality technical subcommittee of the Pacific Southwest Inter-Agency Committee.

Interior, as you know, has wide range in responsibilities in water and land matters in the Pacific Southwest. Our statement today will cover our work with water development, management, quality control, and basic data collection in the Colorado River System.

W. T. Davoren

Interior's responsibilities on the Colorado have received a great deal of attention recently, particularly due to the problem of filling Glen Canyon Dam and Lake Powell behind Glen Canyon Dam.

Two recent definitions from that experience may help illustrate Interior's role in the Pacific Southwest as far as the Colorado River is concerned. One was the phrase the Secretary of the Interior used when he ordered the closing of Glen Canyon's gates down to 1,000 c.f.s. on May 11th. Part of this announcement said, "This was one of the most difficult decisions I have had to make as Secretary."

Another definition I heard recently came from a person who has been struggling with the long-term annual flow problem of the Colorado River. After reviewing the sixty-year annual flow history, he got an inspired look on his face, looked up and declared empirically: "The Colorado River is the world's largest intermittent stream."

(Laughter.)

I would like to introduce the men here today who represent various Bureaus of the Department of the Interior. Mr. Klashman covered several of them earlier.

Representing the Bureau of Reclamation earlier was Mr. A. B. West, Regional Director, Region 3, Boulder

City. He had to catch a two o'clock plane.

Mr. Leroy Holmes, River Control Engineer of Region 4 of the Bureau of Reclamation, Salt Lake City, is here.

Maurice Hastings, the Assistant Chief for Irrigation Operations of Region 3, Boulder City, Nevada, is here.

Fred Houck, Chief of the Engineering Branch of the Project Development Division, Region 3, Boulder City, is here.

Would you gentlemen please stand up?

Next is the Geological Survey. Mr. Paul Benedict, Branch Area Chief, Water Quality Branch, Pacific Coast area, Menlo Park, California.

Mr. C. C. McDonald, Project Hydrologist, Lower Colorado River Hydrologic Study, Yuma, Arizona.

Mr. Burdge Irelan, Project Chemist, same project, Yuma, Arizona.

Mr. Horace Babcock, District Chief for the Water Resources Division of Arizona, Tucson, Arizona.

Other Bureaus represented include the Bureau of Mines, Mr. Del D. Blue, Chief of the Metallurgy Research Laboratory at Boulder City, Nevada, who is here.

From the National Park Service we have Mr.

Charles Richey, Superintendent of the Lake Mead National Recreation Area, Boulder City, Nevada.

From the Lower Colorado Land Use Office, Mr. Mel Crosby, Assistant Administrator, Yuma, Arizona.

Before introducing Mr. Langley, I should give you a little background about him.

He spent some thirteen years on the Lower Colorado River and was Chief of the Operations Division at Yuma, Arizona, before moving to Washington about five years ago.

In Washington, he was Chief of the Irrigation Branch, until recently promoted to Acting Chief of the Division of Irrigation and Land Use.

I would like to give you Mr. Maurice Langley, who will read the Department of the Interior's statement.

STATEMENT OF MAURICE N. LANGLEY, ACTING CHIEF, DIVISION OF IRRIGATION AND LAND USE, UNITED STATES BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR, WASHINGTON, D.C.

MR. LANGLEY: Thank you, Bill.

Mr. Chairman, conferees, ladies and gentlemen:

Secretary Udall asked that I extend his greetings to this conference for its success.

I think before going into this statement, I would like to report off the record an item this morning.

(Discussion off the record.)

MR. LANGLEY: The broad interest of the Department of the Interior in water quality and related problems of the Colorado River System is reflected in the Department's agencies represented at this conference. Each of these agencies has a program in the field of water quality or closely related thereto. While each of the agencies has its own program, the Department exercises the administration necessary to assure that all programs are coordinated to avoid duplication and to achieve maximum results. The responsibilities of the Secretary of the Interior for the administration of the Colorado River is perhaps best illustrated by a quotation from the Supreme Court decision of June 8, 1963, in the case of Arizona v. California, to wit:

> "Today the United States operates a whole network of useful projects up and down the river, including Hoover Dam, Davis Dam, Parker Dam, Headgate Rock Dam, Palo Verde Dam, Imperial Dam, and Laguna Dam * * *. It was only natural that the United States, which was to make the benefits available and which had accepted the responsibility for the project's operation, would want to make certain that the waters were effectively used. All this vast interlocking machinery -- a dozen major works delivering water according to Congressionally fixed priorities for home, agricultural and industrial uses to people spread over thousands of square miles -- could function efficiently only under unitary management, able to formulate and supervise a coordinated plan that could take account of the diverse often conflicting interests of the people and communities of the Lower Basin States. Recognizing this, Congress put the Secretary of the Interior in charge of these works and entrusted him with

"sufficient power * * * to direct, manage and coordinate their operation."

This report to the fifth conference on interstate pollution of the Colorado River will attempt to give only a skeleton outline of the activities of each agency in Interior and in a few cases cite the Congressional authorities and mandates of Congress under which this work has been accomplished.

Geological Survey

The Geological Survey continued investigations of water resources in the Colorado River Basin in 1963-64 under general authority of the Survey's Organic Act (March 3, 1879) and under specific authorization of successive annual Congressional appropriations.

A collection of basic data on the quantity and quality of surface and ground waters was continued throughout the Basin. During the past year the Survey operated 147 water quality stations, of which 50 obtained data on chemical quality, 36 on sediment measurements and 61 for temperature observations. There were somewhat less than 147 separate quality measurement sites, inasmuch as two and frequently all three kinds of data were collected at the same site. This data was correlated with data obtained at the streamflow gauging stations.

An intensive study of the hydrology of the Lower Colorado River area was begun in 1960 and will continue through 1966. The objective of the study is to define the hydrologic regimen of the area in all its aspects. Emphasis has been placed on the appraisal of ground water occurrence and availability, knowledge of which is a necessity for full development of the water resources of the area. The study includes appraisal of chemical quality and of consumptive use of water by vegetation, and also traces the movement of water in surface channels, canals, drains, and wasteways. In addition, research is being conducted on hydrologic problems at national, regional and local levels, which will have application to the Colorado River Basin.

Preliminary results of the Lower Colorado River studies are made available in two ways. Advance reports are released from time to time as significant results are obtained and an annual conference is held with interested Federal and State agencies, at which time progress reports are presented. Summary reports for formal publication will be prepared as specific phases of the study reach completion.

M. N. Langley

Fish and Wildlife Service

In connection with fishery management studies carried out by this agency in cooperation with four State fishery departments, data is being collected from Lake Powell, Flaming Gorge, and Navajo reservoirs, as well as from downstream areas below the dams, on temperature, turbidity, pH, dissolved oxygen, free carbon dioxide, total hardness and alkalinity. Samples generally are taken at monthly or bi-monthly intervals at several stations on each project.

These data are being collected with project funds under the authority of Section 8 of the Colorado River Storage Project and Participating Projects Act of April 11, 1956. The investigative work by other Interior agencies is reviewed by the Fish and Wildlife Service to avoid duplication of effort.

Reports on the findings will be prepared respectively by the States of Wyoming for Flaming Gorge Reservoir, Utah and Arizona for Lake Powell, and New Mexico for Navajo.

Bureau of Land Management

Although representatives of the Bureau of

Land Management are not in attendance at this conference, that Agency asked that we inform the conferees of its interest in the subject program.

The Bureau of Land Management points out that past and proposed range rehabilitation and soil and moisture structural treatment programs aimed at soil stabilization and reduction of silt and sediment discharge from Federally administered lands in this drainage basin would have an important bearing on water quality improvements.

Bureau of Mines

The Bureau of Mines has done a great deal of work related to water use and pollution prevention as a part of its mineral investigations, under authority of its Organic Act of 1910 and also from a section of the United States Code identified as "16 U.S.C. 665."

Bureau of Mines programs have dealt with the quality of water primarily in relation to water as a commodity, necessary to the successful operation of the mineral industry. Quality of water needed in secondary oil recovery is a fair example. Quality of water and its relation to milling problems is another. Studies of effluents from mineral mining and processing industries have also been made. One purpose is to save and utilize valuable constituents in water-borne wastes and another is to find ways to abate a nuisance in an economic manner which will permit the mineral industry in question to survive. One study made at the request of the Atomic Energy Commission, and thoroughly reported at past conferences on Colorado River pollution, was its successful solution of the problem of radioactive water-borne wastes from uranium mills. That matter is no longer a problem.

The Bureau of Mines is recording all the data on their Colorado River Basin surveys by means of automatic data processing equipment and, upon conclusion of the investigations, a summary report will be prepared either on a State or regional basis.

National Park Service

The National Park Service does not conduct water quality research or collect data on quality of water in the Colorado River. By Memorandum of Agreement of July 1955, United States Public Health Service serves as consultants to the National Park Service in all matters relating to environmental health services and also consultants to its Division of Design and Construction regarding the construction of water, sewer and any other facilities wherein sanitation is involved. Accordingly, the Public Health Service has approved the construction drawings for all water and sewer systems located in the recreational areas involving the Colorado River. Also it inspects all water and sewer systems in the recreational areas at least annually and periodic water samples are taken from all water systems, and submitted to the laboratories of the respective State's health department for testing.

The river itself or its major tributaries are important parts of more than a dozen areas that are administered wholly or partly by the National Park Service. In addition, the National Park Service advises State and local agencies on the establishment of additional recreational areas which are not of Federal interest. Thus the quality of water of the Colorado and its tributaries has a direct effect on National Park Service operations.

Office of Saline Water

The Department has interest and responsibilities in the general area through its saline water conversion activities.

Many of you folks here visited our saline water conversion plant at San Diego last year.

The Act of 1961, under which the Office of Saline Water operates, defines saline water to include "sea water, brackish water, and other mineralized or chemically charged waters." The objective of the Act is to provide means of obtaining from such sources, water of a "quality suitable for municipal, industrial, agricultural, and other beneficial consumptive uses." Thus, those polluted waters which are also saline waters, are potential sources for the application of conversion processes.

Also, there is an intensive interest in general pollution problems as they relate to the saline water supply for conversion plants in either Office of Saline Water demonstration plants or cooperative water supply plants, i.e., sources of saline waters for plants that are going to be needed in many areas will not be "clean" saline waters but will also be contaminated or polluted. The Office of Saline Water is also necessarily concerned with pollution, which, even though in small amounts, could cause trouble in conversion plants or product water.

In this advancing technology, there may be possibilities for combinations of saline water conversion and sewage effluent treatment plants. In these areas where there are mutual interests, the Office of Saline Water will continue its cooperation with the Department of Health, Education, and Welfare.

Bureau of Reclamation

Three principal field offices of the Bureau of Reclamation, i.e., Denver, Colorado; Salt Lake City, Utah; and Boulder City, Nevada, participate in this program. The Office of Chief Engineer at Denver is conducting a limnology study of Lake Mead which will provide data on water quality changes caused by Lake Powell storage. The water quality character of Lake Mead is expected to change significantly with the changing river flow resulting from storage of water in Lake Powell and other reservoirs of the Colorado River Storage Project. Preliminary studies at Boulder Basin at Lake Mead, to be performed late in fiscal year 1964, will give a foundation for the proposed comprehensive study in fiscal year 1965. Measurements of dissolved oxygen, dissolved carbon dioxide, temperature and other pertinent factors at various locations and stations in the reservoir will be used to determine the changes in water quality taking place.

The Colorado River Storage Act of April 11, 1956, the Navajo Indian and San Juan-Chama Irrigation Projects Act of June 13, 1962, and Fryingpan-Arkansas Project Act of August 16, 1962, specifically directed the Secretary of Interior "* * * to continue his studies of the quality of water of the Colorado River system, to appraise its suitability for municipal, domestic, and industrial use and for irrigation in the various areas in the United States in which it is used or proposed to be used, to estimate the effect of additional developments involving its storage and use (whether heretofore authorized or contemplated for authorization) on the remaining water available for use in the United States, to study all possible means of improving the quality of such water and of alleviating the ill effects thereof, and to report the results of his studies and estimates to the Congress * * *."

The first major report under this Act prepared jointly by the Bureau of Reclamation and the Geological Survey was submitted to the Congress in early 1963. The report has been distributed widely to State agencies in the Colorado River Basin and other interested parties. A number of new daily sampling stations were established to provide data for this and subsequent reports under a cooperative program with the Geological Survey. The Bureau of Reclamation has also sampled at least 100 locations each year in tributaries, canals and drainage systems at frequencies ranging from 6 to 24 per year. These waters have been analyzed to determine their suitability for project development uses. All of this work by Bureau of Reclamation is being closely coordinated with that of Geological Survey as was done when the two agencies prepared the first report in 1963.

In the Lower Colorado River Basin Reclamation has been conducting a water quality program for many years under the authority of the Boulder Canyon Project Act. Water quality along the main stem of the river is checked by daily samples taken at key stations operated by the Bureau in cooperation with the Geological Survey. Samples are taken above each project diversion and below the point of farthest downstream return flow from the respective project. Thus these data assist in evaluating the effect irrigation has on water quality in each section of the river. Before the river was controlled by construction of storage dams and reservoirs, wide variation of flow and related salinity occurred. With regulation water of a more uniform and improved quality is delivered to our contractors. Through construction of reservoirs and channel rectification, the silt content of the river also has been significantly reduced.

Therefore, to summarize briefly, the Department of the Interior is intensely involved in maintaining the quality of water in the Colorado River Basin at the highest level possible consistent with the many demands on the stream system and the various compacts, laws, contracts, and other agreements relating to the storage, diversion and use of the waters of the river. With increasing demand on the water and consequent appreciation in value in this arid area, we must emphasize that available supplies must be used and reused to the greatest practicable extent. Every alternative means of pollution control must be practiced before reservoir releases can be used solely for dilution purposes.

The Department of the Interior, and the many agencies in it dealing with water problems, remain ready to fulfill their responsibilities to the States and to the nation. We welcome this opportunity to clarify our role and to continue the work with the Department of Health, Education, and Welfare, with its Public Health Service, and other State and Federal agencies dealing with the problems of the Colorado River.

Thank you.

MR. STEIN: Thank you, Mr. Langley.

Are there any comments or questions?

(No response.)

MR. STEIN: Well, thank you very much for an excellent statement.

As you people know, the Department of the Interior is one of our sister agencies in the field of water pollution control, and one we work very closely with on a day-to-day basis.

Mr. Klashman?

MR. KLASHMAN: The Department of Agriculture is not giving a statement, and that concludes our presentation by the Department and the other Federal agencies.

Mr. Stein, in accordance with our past practice, I suggest that we let the States call on the industries to give their statements for the States concerned.

MR. STEIN: That will be in accordance with the law too.

MR. KLASHMAN: Thank you.

MR. STEIN: May we call on Wyoming first, Mr. Williamson?

STATEMENT OF A. E. WILLIAMSON, CONFEREE;
DIRECTOR, DIVISION OF ENFORCEMENT AND
SANITATION, WYOMING DEPARTMENT OF PUBLIC
HEALTH, STATE OFFICE BUILDING, CHEYENNE,
WYOMING

MR. WILLIAMSON: I don't think I have a lot to add to the particular comments that have been made.

I think during the past year, our progress has followed pretty much the outline of our last session.

I think it appears at this time that we have some answers here during the next year for the things we have been looking for. I am well satisfied with the progress.

MR. STEIN: Thank you, Mr. Williamson.

Are there any comments or questions?

(No response.)

MR. STEIN: May we call on Utah, Mr. Thatcher?

STATEMENT OF LYNN M. THATCHER, CONFEREE; EXECUTIVE SECRETARY, UTAH WATER POLLUTION CONTROL BOARD, 45 FORT DOUGLAS BOULEVARD, SALT LAKE CITY, UTAH

MR. THATCHER: Could I back up a little bit and ask a question that I forgot to ask before?

MR. STEIN: Surely.

MR. THATCHER: The project staff made a recommendation that attention be given to the effluent from the Mexican Hat mill with respect to radioactivity.

If the Utah Water Pollution Control Board chose to take action on this, they would also want information on other contaminants, other chemicals, and I am wondering if the staff has some information on this available that we could get?

I don't know which person could answer that.

MR. KLASHMAN: Charlie, do you want to answer that, please?

MR. SPONAGLE: I am not sure that we have any chemical results from that effluent. I would have to check it and advise you later.

MR. THATCHER: All right. Do you want me to call on --

MR. STEIN: Yes.

MR. THATCHER: I am not sure that there are any of the industries or other people in Utah who were concerned with this problem, who wanted to make statements today. I have no specific requests from anyone, so I will just ask if there is anyone from the State of Utah who would like to make a statement.

STATEMENT OF JOHN B. GOFF, METALLURGIST,
AZ MINERALS DIVISION, ATLAS CORPORATION,
BOX 488, MOAB, UTAH

MR. GOFF: My name is John Goff. I am Chief Metallurgist with Atlas Minerals. I am representing AZ Minerals or the Mexican Hat mill.

MR. STEIN: AZ?

MR. GOFF: That is correct. AZ Minerals Corporation. That is wholly owned by Atlas Corporation.

AZ Minerals Corporation, a division of Atlas Corporation, acquired the Mexican Hat mill or July 28, 1963. Until October 1, 1963, radiation monitoring and control was continued by personnel of Texas-Zinc Minerals, at which time they were relieved by AZ Minerals personnel.

Upon reviewing the radiation files of Texas-Zinc Minerals, we found that Radium 226 and Thorium 230 levels in the effluents did not consistently meet with the Atomic Energy Commission requirements as set forth in 10-CFR20.

At that time we initiated our own program of sampling and assaying to evaluate remedial measures by

J. B. Goff

which radiation levels could be lowered to specification levels.

Since then we have installed continuous proportional sampling and flow measuring equipment on the effluent stream. Average effluent flow to the San Juan River, since these devices were installed, has been 22.3 gallons per minute. This is due partially because we are down on tonnage to about 25 percent of what had been run at Mexican Hat at the time of the sampling in 1963, as recorded on the tables.

We do intend to lower radiation levels in the effluents as techniques are developed. However, we would like to point out that we feel, with the effluent flow rate as it is today, that current radiation levels in the San Juan River resulting from these effluents would be difficult to detect analytically.

Our current data indicate that the greatest single source of our radioactivity in the effluent is in one specific ore from a mine where the natural thorium is present in about the same concentration as uranium in the ore.

In all other mines supplying the Mexican Hat mill, the ore contains only trace quantities of thorium, and the mine supplying the high thorium is currently shut down.

This should result in a very substantial cut in radioactive thorium in the effluent.

The second contributing factor has been that we have recycled 70 percent of the raffinate liquor in the mill, resulting in a high buildup of radioactive action in the mill solution. This won't cut down the total radioactivity with respect to the stream. However, it will be reduced and we will be substantially in the same position as the flow rates we have previously noted.

We anticipate that as the circuit is purged of the ores from this one specific Alaskan mine, the radiation levels in the effluents there will drop substantially.

Thank you.

MR. STEIN: Thank you, Mr. Goff. Just a moment.

Are there any questions or comments?

(No response.)

MR. STEIN: If not, Mr. Thatcher?

MR. THATCHER: Thank you, Mr. Goff.

Are there any others from Utah now who would like to speak?

MR. STEIN: Yes, sir.

STATEMENT OF HENRY BATY, RADIATION SAFETY OFFICER, ATLAS MINERALS DIVISION OF ATLAS CORPORATION, MOAB, UTAH

MR. BATY: My name is Henry Baty, Radiation Safety Officer, Atlas Minerals Division of Atlas Corporation.

This statement by Atlas Minerals is a brief history and progress report of our efforts to control the discharge of radioactive material to the Colorado River.

The Moab uranium mill now operated by Atlas Minerals Corporation began operations in October 1956. During the first three years, the mill operated as an acid leach RIP plant and the acid tailings were neutralized by the addition of crushed limestone. The limestone was added in the mill prior to releasing the tails to the tailings pond to allow time for precipitated material to settle. Clarity of the pond discharge was controlled with a strategically located decant tower which could be adjusted to prevent the escape of suspended solids. We continued with this method of treatment until November 1959, when the mill circuit was changed from an acid leach system to a combined acid and alkaline mill. While redesigning the circuit was not accomplished primarily as a means of controlling the discharge of radioactive material to the Colorado River, the smaller quantity of radionuclides dissolved by the alkaline leach circuit and the complete neutralization of the combined mill tails did result in lower concentrations in the effluent.

By early 1960, the tailings pond had grown to the point that a single decant tower was not sufficient to control the discharge of suspended solids. In May 1960, we devised a rotating system of decantation and installed a secondary settling basin to provide final polishing of the effluent prior to releasing it to the Colorado River.

In the beginning our sampling and monitoring program consisted of a monthly grab sample of effluent and monthly samples of the Colorado River above and below the mill. This was later expanded to include daily samples of the effluent, samples of the Green and Dolores Rivers above their confluences with the Colorado, plus 13 sampling stations on the main stem of the Colorado. In all we had 15 sampling stations and were monitoring 100 miles of the Colorado on a monthly basis. In October 1960, we installed an automatic continuous sampler on the effluent stream and a Parshall weir to measure the flow. We continued with the expanded program for about two years. Since October, 1961, we have been monitoring the Colorado above the mill and for 10 miles below the mill.

In December 1960, the plant was converted to an all-alkaline leach system. This resulted in further reductions in the concentrations of dissolved radionuclides in the effluent.

During the summers of 1960 and 1961, we made extensive plant scale tests using barium sulfate as a means of removing the dissolved Radium 226 from the effluent. In the spring of 1962, we began full-time treatment with barium sulfate.

By the spring of 1963, it appeared that although significant reductions in the concentration of Radium 226 were achieved with the barite treatment, we could closely approach but not quite meet 10CFR20 specifications with this method and began laboratory scale testing of other possible decontamination methods.

During the summer of 1963, we installed the necessary equipment, including another large settling basin in series with the original tailings pond and settling basin, and in September 1963 began treating the effluent with a barium chloride solution.

The results achieved with this method to date indicate that there should be no further difficulty maintaining an effluent which meets 10CFR20 specifications for Radium 226. The concentrations of Thorium 230 and natural uranium occur in the Moab mill effluent at levels below those specified in 10CFR20.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: I don't think the significance of this and the other statements of the mill representatives should be overlooked, as the efforts that all the uranium mills have made and are making to improve their effluent consistently.

Again, I would like to emphasize that I don't think there has been an industrial response like this in the entire country, and I think, considering the nature of the region and the wastes, this has been a lucky thing for all of us. The industry really is to be commended.

Mr. Thatcher?

MR. THATCHER: Are there any further comments by representatives from Utah industries or from municipalities?

(No response.)

MR. THATCHER: If not, I can complete my statement very quickly, Mr. Stein.

First of all, I want again to thank and compliment the staff for the work they are doing and the help they are providing, and suggest that the pattern developed for the conduct of this work is highly acceptable.

I have nothing additional to offer beyond the comments that have already been made, and I presume that you will fill your usual role of summarizing, so I don't need to take any time to go into the points that have been brought out previously.

Thank you.

MR. STEIN: Thank you, Mr. Thatcher.

Mr. Caldwell?

MR. CALDWELL: Are there any industry representatives from New Mexico?

(No response.)

MR. CALDWELL: If not, I would like to recognize Mr. Robert Lowe, who is Chief of our Water Pollution Control Section of the New Mexico Department of Public Health. If it is all right with you, Mr. Chairman, Mr. Lowe has some information on some samples that were taken recently that might be of interest to the group.

MR. STEIN: Certainly.

MR. CALDWELL: Mr. Lowe.

STATEMENT OF ROBERT P. LOWE, CHIEF, WATER AND SEWAGE SECTION, NEW MEXICO DEPARTMENT OF PUBLIC HEALTH, 408 GALISTEO STREET, SANTA FE, NEW MEXICO

MR. LOWE: I am Robert Lowe, and I am with the New Mexico Department of Public Health. I have just a brief statement to make.

I would like to say that when this problem in relation to the uranium mining and milling industry first came up in New Mexico, we were watching for radiological indicators. Instead, we found we were in trouble afterwards in relation to chemical pollution problems from this uranium milling industry.

This is just to show you what problems can come up. Recently, we have had some additional problems come up.

I would like to refer to this Table 1 that Dr. Tsivoglou has in his report with relation to the average liquid wastes radioactivity content (P. 144).

On Page 4 of that table -- I was reading Page 2 of the table, but it is known as Page 4 -- under the Shiprock, New Mexico, V.T.A. mill, we note there that the uranium has micromicrocuries per liter in the seep there, and is listed as 800 micromicrocuries per liter.

According to this factor here, that is about 1,200 micromicrograms of uranium per liter.

Isn't that right, Dr. Tsivoglou?

DR. TSIVOGLOU: Yes.

MR. LOWE: We have some results that compare to that. Most of these results Dr. Tsivoglou has given here are not natural effluents. There are also results on effluents that are not mixed waters in stream, as is the case here for the Shiprock mill, that has a very small seep that is diluted by the San Juan River.

I would like to bring that out because we have another problem that I was getting to here with relation to the Ambrosia Lake area in New Mexico, where we have dewatering of mines by pumping to the surface to create surface water drainage, and the results that we have been obtaining on discharges there, of these micrograms of uranium per liter, were results ranging from over 2,000, from 2,200 here to 3,700 micrograms of uranium per liter. Well, that we have obtained.

Now, we have been using as indicators in this uranium monitoring network report that the conferees received -- I don't know how many of you received it -- but in that it is indicated the use of uranium as an indicator

-- merely as an indicator for radiological pollution.

Now, we are using that uranium as an indicator, because it is easier to analyze and test for uranium. We plan to follow up our results in this case, on these results that I have quoted, on checking the Radium 226 content in relation to possible pollution of wells in the area.

In this case, we are vitally concerned with this mine drainage and the possibility of contamination of drilled wells for individuals, and possibly in underground water in the future, where, with the lapse of time, there may be the contamination of some community water supplies in that area.

We are quite interested to see what the facts develop on this. That is our program at the present time in relation to this mine water drainage. It is something that we had not been checking in relation to the uranium mining and milling operations in the past.

I thought that would be of interest to the conferees here and the conference, although the actual case that I have mentioned is outside the actual Colorado River Basin -- just outside of it. However, it brings out the problems and also the magnitude of some of these compared to the results on an average here of so-called non-background, in your non-background results here of micrograms per liter of uranium of only 10.9, in comparison with these results that we have obtained up there of several thousand micrograms of uranium per liter.

One other comment I would like to make in relation to this concern that we have had, and Mr. Caldwell has brought it out, is in relation to abandoned mill tailings piles.

Of course, we are quite concerned in New Mexico with relation to one specific incident where we are right below it in New Mexico, while this is in another State above it.

It appears that this problem, as brought out, has not been resolved as far as specific responsibility. We were quite concerned because of a letter that came out.

The gentleman from the Atomic Energy Commission has explained this somewhat, but there has been quite a little concern about that letter. Also it appears that the problem refers to specific cases.

This one case that we are concerned about is, we don't question that there is a problem there from the results that we have obtained. It seems that it resolved down to surveys. I understand some surveys have been made of various mill tailings piles, and specifically abandoned mill tailings piles. It seems to resolve down to the fact that there are specific cases that are more dangerous than others, or can create problems more than in other instances. We are specifically about this one instance that is immediately upstream outside of the State of New Mexico.

Thank you.

MR. STEIN: Thank you, Mr. Lowe.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, Mr. Caldwell, do you have anything else?

MR. CALDWELL: Yes. I am going to step out of my role for a minute and introduce the Public Health Service Officer from New Mexico -- I don't believe you were introduced this morning -- Art Johnson, Public Health Service Engineer with the Division of Indian Health.

Art, did you have anything you have anything you wanted to say?

MR. JOHNSON: No.

MR. CALDWELL: All right.

STATEMENT OF CHARLES G. CALDWELL, CONFEREE; PROGRAM DIRECTOR, DIVISION OF ENGINEERING SANITATION, 408 GALISTEO STREET, SANTA FE, NEW MEXICO

MR. CALDWELL: I will conclude my statement by saying that we are very pleased with the results of the work of the project.

The radioactivity in the water has been played up for some time. That is with specific regard to our municipal water supplies.

I might also point out that since the last meeting of the conference, the mill at Durango has closed up and moved down to Shiprock, so we are now an upstream State and not a downstream State.

(Laughter.)

Thank you.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. STEIN: If not, we will call on Nevada, the home State, Mr. Wallace W. White.

Mr. White.

STATEMENT OF WALLACE W. WHITE, CONFEREE;
CHIEF, NEVADA DIVISION OF HEALTH, 790
SUTRO STREET, RENO, NEVADA

MR. WHITE: In a previous conference, Mr. Fitzpatrick, I think, mentioned that water quality in the Colorado was directly related to dilution -- that is, stream flow.

With the recent publicity on storing in Lake Powell, and another one by Mr. Langley that these upstream uses couldn't but have some reflection and change in downstream use, I would like to call attention to this:

Lake Mead is the water supply for this area. I don't know what you do with your water. I have heard of some uses for irrigation, fish, and so forth, but this is the water supply for this particular area.

The quality has to be maintained, and this is getting up there fairly high now, Mr. Langley, in solids. It is a playground, and we are already having many questions asked of us with regard to our own discharges.

We suspect -- in fact, we know that we are being pushed to give more information on our discharges back into the stream. Some of the blame is about our Las Vegas or our Sanitation District plants, or wastes, and so forth. We are being pushed into some determinations and analyses, and it is extremely fortunate, I think, right now, that this conference is existing and is at the stage of their investigations, so that these problems can be determined, evaluated and regulated.

Of course, I have added the pesticide one to the rest of them. I think there have been some attempts to throw some others in. I am not as impressed with the evaluation of costs, and I will throw this one at you just to make you think about it.

I recently had to make an analysis of our costs at Lake Tahoe. For the treatment of a million gallons of sewage at Lake Tahoe we are paying $1,200 per million gallons. Now, match it anywhere. So you will see why I am not so horribly interested in your costs, or the costs that may be necessary to protect this water from chemical pollution down here.

Thank you.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, we would like to call on Colorado. Mr. Frank Rozich.

MR. ROZICH: I believe we have an industry representative here. I see Mr. Beverly from Union Carbide in the audience.

Do you have a statement, Mr. Beverly?

STATEMENT OF ROBERT G. BEVERLY, ADMINISTRATOR-RADIATION CONTROLS, UNION CARBIDE CORPORATION, NUCLEAR DIVISION, GRAND JUNCTION, COLORADO

MR. BEVERLY: Mr. Stein, conferees, ladies and gentlemen:

Next month will mark the completion of our fifth year of radiological studies and routine monitoring of all liquid effluents from Union Carbide's uranium mills and of the rivers above and below the mill locations. At the previous four sessions of this conference I have reported to you on the more significant results of this extensive monitoring program and on the progress we have made in pollution abatement. We continue to follow with interest the work of the Public Health Service's Colorado River Basin Project and have maintained close liaison with personnel in the headquarters office in Denver.

Perhaps the most significant development over the past year, which will be of interest to you, is our work at Uravan, Colorado, in the construction and use of evaporation-seepage ponds for effluent disposal. The first pond, with a surface area of approximately 7 acres, was put into use last summer. Two additional ponds with a combined surface area of about 10 acres were built late last year. The second one is presently filling. Total excavation for the three ponds was 131,000 yards.

Studies on the operation of the ponds include the determination of rates of evaporation and seepage, construction and monitoring of test wells around the ponds, along with continuous weather observations, such as temperature, rainfall, humidity, etc. Thus far we have noted that seepage has accounted for the loss of about 50 percent of the input and evaporation has accounted for about 5 percent. With the summer months commencing and with a larger surface area this year, we expect a significant increase in losses by evaporation. To date there is no evidence of seepage to the San Miguel River. Samples taken of minor seeps from the No. 1 pond to the gravel in the bottom of a lower pond during the construction stage showed no significant chemical or radioactive constituents.

The use of the disposal ponds has reduced the radioactivity released to the river and, of more local significance, has improved the appearance of the river.

Because of the naturally high salinity content of the Dolores River, we have not noted any detectable difference in the chemical water quality downstream.

Two years ago, at the Salt Lake City conference, I reported what we felt to be a significant observation from our own monitoring studies; the fact that the major quantity of soluble radium being carried by the main stem of the Colorado River over any one-year period was originating from natural sources. It also appeared that the greater part of this naturally-caused radium load came down the rivers during the spring runoff period. The radium concentrations determined by the United States Public Health Service Colorado River Basin Project on their weekly or monthly composited river samples, which were started late in 1961, when multiplied by the quantity of stream flows, have corroborated these earlier observations. For example, we note that during the first year of operation of the United States Public Health Service radium monitoring network, the quantity of soluble radium carried by the Green, Colorado, Gunnison and Dolores Rivers during the four months of spring runoff was about 60 percent of the total amount carried by these rivers during the entire year. When we compared the amount of soluble radium contained in the Union Carbide uranium mill effluents with that carried by these rivers over the same period and above any mill locations, the radium in the effluents totaled less than 5 percent of that originating in the rivers from natural sources.

Although the highest radium concentrations during low water periods remain as an important factor to be considered, the source of and the total quantity of soluble radium being delivered to reservoirs such as Lake Powell and Lake Mead is also of significant, and frequently overlooked, importance.

Now, regarding the lead and polonium in the Rifle mill effluent discussed earlier, I believe our methods of approach and our efforts over the past five years should indicate our sincere concern in such matters. This is a matter which has been under consideration for over a year, and will continue to be of concern to us.

As you are aware, and as you stated earlier, Mr. Stein, the analytical methods involved are "very, very difficult." Of necessity, the analytical development work must precede the problem analysis.

Concurrently, however, we are studying the economic and technical feasibility of alternate disposal methods.

Again I wish to express our appreciation for being invited to participate in this conference. We have enjoyed our relationship with Mr. Sponagle and will continue to cooperate with Mr. Rademacher and his group in any manner possible. We also want to wish Mr. Sponagle success in his new assignment.

Thank you.

MR. STEIN: Thank you, Mr. Beverly.

Are there any comments or questions?

(No response.)

MR. STEIN: Thank you.

I would also like to commend again Mr. Beverly and Union Carbide in particular, as one of the many companies which have been most cooperative with State and Federal authorities.

I think your company has a record to be proud of. It is meeting a difficult question, approaching this absolutely candidly and wholeheartedly with all the regulatory authorities, and exchanging information and being entirely cordial.

Thank you.

MR. BEVERLY: I would like to add one more comment.

I could not help but be interested in all this discussion on tailings piles. It is truc we are very concerned about them also. I believe I might speak for all of industry if I would say we would appreciate the courtesy of being invited to the meetings at which we discuss, or it is discussed what is to be done with our property and with our money to do the work. We also feel we have some competent engineers, so we would appreciate participating in these meetings.

MR. STEIN: Mr. Beverly, I am with you.

MR. BEVERLY: Thank you.

MR. STEIN: I hope the representatives of our Department and the Atomic Energy Commission are listening to that.

Off the record.

(Discussion off the record.)

MR. STEIN: All right.

MR. ROZICH: Are there any other representatives of industry in Colorado that wish to make a statement?

Mr. Beverly, I believe you have a gentleman there with you from your company. Would you introduce him?

MR. BEVERLY: No. He is from Utah. He is another industry member.

MR. ROZICH: I see.

MR. BEVERLY: I don't think he has any statement to make.

MR. ROZICH: All right.

STATEMENT OF FRANK ROZICH, CONFEREE;
SENIOR PUBLIC HEALTH ENGINEER, COLORADO
DEPARTMENT OF PUBLIC HEALTH, 4210 EAST
11TH STREET, DENVER, COLORADO

MR. ROZICH: I have a prepared statement that I would like to read.

Mr. Chairman, fellow conferees, ladies and gentlemen:

As in the past, this statement not only reflects the position of the Colorado State Department of Public Health, but several other State agencies having jurisdiction over water pollution in the Colorado.

First, we wish to commend the project staff for the work they have done in the past and the work they are presently doing to present to the States in the Basin a comprehensive study of pollution and pollutants in the Colorado River Basin.

The discharge of radioactive waste to the Animas River instigated this investigation; however, the emphasis has now been shifted toward evaluating the salinity problem in the lower areas of the Colorado River Basin. An economic base study is also underway in the Lower Basin

States.

Since it is planned to conduct similar studies in each sub-basin, we feel that the information gathered will be valuable to our State in planning future growth on the western slope. However, we are concerned as to whether the gross regional product of the lower basin is to be increased at the expense of the upper basin States.

Taking as a cue Mr. Murray Stein's statement that one of the purposes of these conferences is "to lay a basis for future action by all parties concerned and to give States and localities an opportunity to take any indicated remedial action under State and local law," the Colorado State Department of Public Health has increased its efforts during the past year in eliminating pollution within the State. In order to give increased emphasis to the Department's Water Pollution Control Program, the State Board of Health on August 12, 1963, authorized the establishment of a Water Pollution Control Section within the Division of Engineering and Sanitation. To staff the new Section, three engineers and an engineering technician were transferred from the Public Health Engineering Section. It is felt that the existence of this new Section lends greater emphasis and prestige to the program; it also allows for better follow-through on violators.

F. Rozich

Since the formation of the new Section, 38 violators of the State's effluent laws have been notified. Eleven violation notices were sent to communities and industries located within the Colorado River Basin in Colorado. As a result of constant pressure by departmental personnel, 28 of these violators in the State and 7 within the Basin have taken steps designed to correct the pollution of our watercourses. We are still working with the 10 violators who have not, as yet, taken positive action. Occasionally it becomes necessary to hold formal hearings before the State Board of Health. Seven such hearings were held during the latter months of 1963.

Treatment of domestic sewage has continued to improve within the State. Of the sewered population of some 93,735 persons within the Basin in Colorado, only 9 percent discharge their wastes without treatment; 19.4 percent provide primary treatment and 71.6 percent or some 67,135 people provide secondary treatment for their waste. The national averages are 16.4 percent for no treatment, 70 percent for primary treatment, and 13.7 percent for secondary treatment. Consequently, it appears that Colorado is doing a much better job than the nation as a whole. An important incentive toward better treatment has been the Federal Grant-in-Aid program. In the past year, four communities on the western slope took advantage of Federal grants to construct sewage treatment facilities with an estimated value of close to $600,000. With the construction of sewage treatment facilities in the Denver Metropolitan Area, the problem is not one of convincing communities to construct facilities, but rather in how to meet their request for Federal grant monies.

During the next fiscal year the Department's staff hopes to be able to measure effluent and stream flows and to determine, in the field, the dissolved oxygen content of effluents, streams and the various treatment plant components. Equipment for conducting these measurements has been ordered. However, staff limitations will permit only limited effort in this direction.

The Colorado State Department of Public Health has not been alone in its efforts to eliminate pollution of the State's streams. During the past year, the Game, Fish and Parks Department, through negotiations, have succeeded in controlling detrimental discharges of industrial wastes from four industries within the Basin. Other State agencies report little or no problems with regard to water pollution.

We in Colorado feel that in recent years substantial progress has been made in our efforts to eliminate violations of our effluent standards. It is hoped that succeeding years will show an even greater rate of improvement.

MR. STEIN: Thank you very much.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, if you will forgive me, I would like to make one comment.

MR. ROZICH: Go right ahead.

MR. STEIN: Specifically, in your statement here you say:

> "However, we are concerned as to whether the gross regional product of the lower basin is to be increased at the expense of the upper basin states."

I think I can assure you that this is not the intention of anyone whom I know, certainly not the Federal Government; but the only way to prevent misunderstanding on this is to have something where we are all working from the ground up together.

I might say I recognize the problem you have in Colorado and in Wyoming and some of the upper basin States. We all have our own provincialism, and, goodness knows, we have it in Washington; but knowing what the problem is living up there in the plateau where the major river system starts, and watching it flow down to these other places, we used to have a man in charge of our Denver office who is now retired. I guess I can tell this.

He used to have a map on the wall showing the Columbia River System and the Mississippi, Missouri and the Colorado, all starting in his region up there on that high plateau and flowing off. He had this kind of animated so the river systems looked as if they were tentacles of an octopus coming into Denver and Colorado and Montana, enveloping him and surrounding him.

(Laughter.)

Off the record.

(Discussion off the record.)

MR. STEIN: I do think that if we are going to get a solution to the Colorado River Basin program, the upper and lower States will have to work together. I think we have to forget these distinctions, and recognize that we have one river basin, and have to make the maximum use of that basin for all concerned.

I really do appreciate your point of view. Thank you.

I wonder if we now could call on California and Mr. Paul Bonderson.

Mr. Bonderson.

MR. BONDERSON: Mr. Chairman, I don't believe there are any industrial representatives from California. If I am mistaken, will they please rise and be recognized?

(No response.)

MR. BONDERSON: I was right.

MR. BONDERSON: I would like to introduce and call upon Dallas Cole, the Chief Engineer of the Colorado River Board of California.

MR. COLE: I have no paper.

MR. BONDERSON: Mr. Cole has with him Don Maughan, one of his engineers. I would like to say hello to Don.

I would also like to introduce Mr. Bevens, a member of the Regional Water Pollution Control Board that borders on the Colorado System.

Mr. Bevens.

MR. BEVENS: Y s. I would like to compliment the conferees for their genuine effort and what they are accomplishing.

MR. BONDERSON: I would also like to introduce Arthur Swajian, the Executive Officer of that Regional Board.

I think that covers California's representation here today.

MR. STEIN: Thank you.

STATEMENT OF PAUL R. BONDERSON, CONFEREE;
EXECUTIVE OFFICER, CALIFORNIA STATE WATER
QUALITY CONTROL BOARD, 1227 "O" STREET,
SACRAMENTO, CALIFORNIA

MR. BONDERSON: I would like to comment briefly on several items here.

First, I mentioned briefly this morning the question of scheduling of some of this activity. I have, on several occasions, been questioned relative to where we are going in this project.

We have been in it for four years now. I think it is time that we should establish a schedule for phasing this out. I would like to see this be one of the items of workload for the coming year.

Every year the conferees -- I am surprised someone hasn't already brought it up -- have asked for the raw data to be submitted to the various States as it is developed. I recognize that your modified program has only really been in effect since last August or September, and it may be a little premature to hope for much concrete established data, but we would hope that this information would be put into circulation as soon as possible.

The last point is, I would hope and trust that in your summary you would cover the points that we discussed this morning relative to including the out-of-basin service areas in economic evaluations and salinity damage in your summary, and also this item relative to the development of the principles or policies that are to guide the final formulation of a water quality management program to be developed during the coming year.

That is all I have to say, Mr. Stein.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, let's call on Arizona, Mr. George Marx.

MR. MARX: Thank you, Mr. Chairman.

I have a number of representatives from Arizona here.

First, I would like to call on Mr. William Copple, who is representing the Governor and the Arizona Lower Colorado River Water Users.

STATEMENT OF WILLIAM P. COPPLE, ATTORNEY, REPRESENTING THE GOVERNOR AND ARIZONA WATER USERS, P. O. BOX 551, YUMA, ARIZONA

MR. COPPLE: Mr. Chairman, for the record, my name is William Copple. I am a member of the Governor's Committee for the Lower Colorado River. I am also counsel for three of the contract water users from the Colorado River in the lower regions of the river in Arizona.

I have also asked to come as a personal representative for the Governor, and in discussing what I have proposed to say, I can say that these remarks are made with the approval of the Governor and the Chairman of our Intrastate Stream Commission.

We are particularly concerned with some of the ramifications of your salinity program. We are particularly concerned this morning with the almost single-handed emphasis as a criterion, objective or standard, solely upon economic reasons.

I would like to mention, just in passing, in one particular instance that while it was discussed very briefly at the conference in La Jolla last year, as I gather from reading the transcript of that meeting, it was brought out again by Mr. Fitzpatrick this morning, as one particular example of economic study in regard to increasing river salinity to the point of the City of Yuma, and discussing the factors involved in determining damage to the City of Yuma as a result of salinity, and weighing economic factors, he mentioned the distance that a new diversion pipeline would have to be run from the City of Yuma to Imperial.

I happen to live in the City of Yuma. My partner, some years ago, was special counsel for the City of Yuma in negotiating and securing a contract for the City of Yuma for some 50,000 acre-feet of water from the Colorado River per year.

At that time the City of Yuma was offered the alternative of taking desilted water, either from the All-American Canal, which is approximately two miles or so from the city, or from the Gila Main Canal, which is slightly more distant, but something in the nature of about 20 percent or less of the distance to Imperial Dam.

The city specifically elected, for reasons of its own, to take its ultimate water right delivery at and just below Imperial Dam.

Now, in evaluating the economic consequences of salinity, how are you going to weigh that policy decision by the City of Yuma, which selected a point of diversion which was more costly than water of the same quality could be secured at other points much, much closer? How are you going to evaluate in determining the effect of salinity on Yuma, Arizona, the fact that something in excess of 100,000 acres there is an irrigated farm base, which made the city possible in the first place, and is the largest single base for its economy now?

I was interested to hear the gentleman from Wyoming mention that there are many, many other objectives and criteria that should be used in determining such things as the economic effect of increased salinity in waters in the Colorado River or any other river.

I was very fearful in noting that all of the mechanics apparently for model studies and the methods of gathering data, the data to be gathered, the method of handling that data, have apparently been established before the criteria and objectives have been fully established and thought out.

Those are things that worry us, and I might say I am not sure whether I am a representative of an industry, agriculture, or a representative of a State agency, although all of the irrigation districts are political subdivisions of the State of Arizona.

W. P. Copple

The remarks that I have here, Mr. Chairman, relate primarily and almost solely to the field of salinity in the Colorado River. I am not talking about radioactive wastes. I wouldn't know if they fell on them. I am not speaking of sewage effluent.

I am talking about the effect of a river on irrigation use and its gradual deterioration in quality from the pure headwaters of the upper basin until they reach the lower river, where we have to use it.

But, as a resident of that area and a representative of that area, of southwestern Arizona, where all of our State's contract divergence from the main stream of the Colorado River is located, we are especially concerned with the problems of the water users of the Lower Colorado River below Imperial Dam.

This area is already subject to intensive water quality studies by a substantial number of State, Federal and international agencies. We are faced with actual and threatened water use cutbacks, as you have read in the papers in the last week or so, with drainage controls, irrigation controls, and a variety of study and enforcement activities from all sides by all agencies.

The Department of Health, Education, and Welfare has also recently found this to be a very fertile field for activity. It is a honey pot and it is gathering lots of bees that we know as we sit there and work with everybody who comes along.

We feel too that from last year's conference report, from our knowledge of the river, and from the work and discussion that even has been had here this morning, that the primary concern, although certainly not the sole concern, is for salinity studies, and so forth, in the lower reaches of the Colorado River, where naturally the salinity is greater; where naturally you have more to work with

However, I would like to call your attention to the following: In connection with the particular problem of salinity increase in the waters of the Colorado River below Imperial Dam, both President Kennedy and President Johnson have been personally involved in the last three years.

For almost three years, the Department of State has entered directly into the matter of salinity of the Lower Colorado River, studies of salinity, studies of its source, studies of its cause, and studies of abatement solution.

A special panel of technical experts appointed by President Kennedy had studied the problem and made substantial recommendations for action in the Lower Colorado River. A committee headed by Dr. Averill Wollman of Johns Hopkins University, as appointed by the President's Special Science Advisor, has studied and investigated the problems of salinity in the Lower Colorado River, and made recommendations for action or further study.

The Bureau of Reclamation has studied the problem as part of its regular job for many, many years, and probably will continue to do so for many years.

By direction of Congress in 1963, the Bureau has expended already six million dollars in studies, planning and construction of works, all directed to control of salinity in the Lower Colorado River. The works are already in operation and yielding very significant benefits in improved water quality.

The International Boundary and Water Commission has been studying the problem of water salinity control in the Lower Colorado River, particularly in the Yuma area, and is continuing intensive work and studies on the problem.

A special committee of 14 representing the Governors of all the 7 Colorado River Basin States, has been meeting regularly on the subject, and will meet in Washington again next week to consider solutions to the salinity problem in the Lower Colorado River, and particularly below Imperial Dam.

As you have heard, the United States Geological Survey has been involved over a considerable period of time in making water quality studies, and particularly as to salinity. As Mr. Maurice Langley pointed out in his statement earlier, representing the Interior Department, there are a great number of other Interior Department Agencies all charged with duties and responsibilities in the Colorado River relating to this problem.

I am sure that outside of what I have mentioned and what Mr. Langley mentioned, there are still other agencies that I have omitted or forgotten, vitally concerned with the salinity problems of the Lower Colorado River, and with the entire Colorado River System, and all of these are continuing to make studies of the amount and causes of such salinity, the future projected increases therein, and methods of correction or control.

One is led to speculate that there must be other areas of water pollution dealing with public health not now being so intensively studied by Federal and State and local agencies, that are more deserving of the attention of the Department of Health, Education, and Welfare, than the salinity problems of the Lower Colorado River.

I think that the subject of pesticides was mentioned this morning. I know that in our area the subject of pesticides, the results, the tolerances, the uses, the applications, the new ones that are being developed, is one of far greater economic and personal interest to the farmers, to the applicators, who stand the risk of damage for misapplication, the manufacturers who stand the risk of damage, who are far more concerned with that as an area of direct personal danger, with no standards, no adequate standards apparently developed for the control of its use, than they are with the water in the Colorado River.

Sewage problems and all of the others have been mentioned. The Department of the Interior and its Bureau of Reclamation are given, by law, the task of controlling and operating the Colorado River for the beneficial use of its waters, for irrigation of arid desert lands, and other purposes, including domestic.

The Boulder Canyon Project Act directed the Secretary of the Interior to make investigations and studies for the purpose of formulating a comprehensive scheme of control of improvement and utilization of the waters of the Colorado River and its tributaries.

The Colorado River Storage Project Act directs the Secretary of the Interior to continue studies on the quality of water of the Colorado River.

From my own direct experience, I can certainly tell you that the quality of the water from top to bottom of the Colorado River and the Colorado River System is well and continuously and continually studied and reported upon by the Bureau of Reclamation and the Geologic Survey. Both these directives in these two Acts are being continuously carried out by the Bureau and other agencies of Interior, and the Bureau is especially concerned with improving utilization of the waters of the Colorado, and with salvage and reuse of those waters in the most beneficial and economic manner.

We are hopeful that the activities of the Department of Health, Education, and Welfare in this area -- and it is obvious that this is now becoming and is a major effort of this particular project -- we are hopeful that they will be limited to such studies and advice as may be sought by the Department of the Interior, and will not constitute a duplication of or interference with Interior's work and efforts and monetary expenditures.

We are especially hopeful that its aims and expenditures will not lead to enforcement activities ultimately by the Department of Health, Education, and Welfare, which will either duplicate or which may be in conflict with the work responsibilities and expenditures of the Bureau of Reclamation, in its studies, planning, control and operation of the Colorado River.

We are particularly concerned in this area because the bulk of the use along the Colorado River, other than that portion of metropolitan waters which is used for domestic purposes, water in the City of Yuma, and some other rather limited domestic uses -- the rest of the water of the Colorado River is used for irrigation purposes, and almost exclusively in connection with a vast system of reclamation projects built under the direction and operated under the direction of the Bureau of Reclamation.

We feel that in areas of agricultural salinity, the Bureau of Reclamation, that its vast experience over many, many years, of farm operations, farm economy, the ability of farmers to repay the cost of these multi-million-dollar projects, is far greater than that which the Department of Health, Education, and Welfare could possibly have because of its lack of association with this area. We feel that it is greatly wasteful to try to build up and develop in a new Department of the Government the same knowledge that has already been built up at great cost to taxpayers, if you want to use what has become almost a trite and wasted statement, by the Bureau of Reclamation over many years. We feel that inevitably, regardless of protestations, that you are going to have a duplication, you are going to be, as I think has already been indicated, installing river sampling installations alongside river sampling stations. "I look at mine and you look at yours." This inevitably will lead to duplication of laboratories, duplication of laboratory work, duplication of administrative effort, duplication of planning and projection, and ultimately to a conflict in enforcement in an area in which the farmers and the water users along the river don't want to look at two agencies, giving them different orders.

As a short summary statement -- and I think as an indication that this is not a position that is taken by irrigation interests in Arizona alone -- I would like to read to you Resolution No. 23 adopted by the National Reclamation Association. The National Reclamation Association is made up of representative from 17 reclamation States, all representatives having to do with irrigation and related direct or indirect portions of that field.

At the 1963 national convention -- and, so far as I know, without any State dissenting -- this resolution was adopted which I would like to read into the record: It was entitled "Water Quality Control on Western Streams."

"Whereas, The limited water supply

"furnished by the rivers of the 17 Western States forms the basis of their civilization which requires primary usage of such waters for the irrigation of otherwise unproductive land, and,

"Whereas, The Bureau of Reclamation has, since its inception, been the agency of the United States Government primarily charged with the Government's responsibility with respect to the development of irrigation utilization of such water, and,

"Whereas, The Bureau of Reclamation has planned and placed into operation, with the specific approval of Congress, numerous water use projects relying for their economic contributions to the nation on conditions of return flow and water quality peculiar to the irrigated West, and,

"Whereas, it appears that the Department of Health, Education, and Welfare has undertaken independent studies in the reclamation area which are unrelated to the historical development of the area, but is in a position to make worthwhile investigations and give valuable assistance to the

"Bureau of Reclamation in meeting the Bureau's responsibilities for a full development of the West's limited water supplies,

"Now, Therefore, Be It Resolved That the National Reclamation Association urges the Executive Branch to make the services of the Department of Health, Education, and Welfare available to the Bureau of Reclamation for such water quality studies as the Bureau may request, and to limit the work of the Department of Health, Education, and Welfare in the 17 Western States to informing and advising the Bureau of Reclamation in matters of water quality control on irrigation projects upon the limitation that the Bureau should exercise final responsibility for action on return flows from irrigated lands;

"Be It Further Resolved That any activity initiated by the Department of Health, Education, and Welfare having any relation to salinity on the Colorado River or its tributaries under the Department of Health, Education, and Welfare's Colorado River Basin Water Quality Control Project be immediately adjusted to conform to these principles."

I think, Mr. Chairman, I have completed the various notes that I have made.

Thank you for the opportunity.

MR. STEIN: Thank you, Mr. Copple.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you for a very forthright statement of your views, Mr. Copple.

Mr. Marx?

MR. MARX: I have Mr. Roswell Jones --

MR. WILLIAMSON: I would like to comment.

MR. STEIN: All right. Mr. Copple, will you come back?

MR. WILLIAMSON: Just an observation. I don't know whether anyone can answer it or not.

I think I am a little confused after all this. It appears to be everybody is studying this, but there is no data available. I mean, you can't find yourself data available in our State on the drainage of the Colorado River. If we didn't have a water quality station down in Utah, you wouldn't know even what was leaving the State.

MR. COPPLE: I can only tell you, Mr. Williamson, that our experience, which has been rather intensive in the last three years, is that we have asked no questions of the Bureau of Reclamation as to water quality history or as to any particular location, and we are speaking particularly from Lee's Ferry down, or from the tributaries, that we have not been given, within a matter of days after requesting it, the information. I have yet to request any water quality information in that area that has not been furnished to us. I have not yet been told that it was not available.

MR. WILLIAMSON: Certainly in the upper reaches I can tell you water quality is a fairly unknown thing, as to data for any period of time. It just hasn't been particularly given any thought.

In fact, we have had to redesign one project because we forgot about the fact that people had to drink the water below it, and it required a whole redesigning of the project.

These things too get involved in that, but I think for all the data that is available, why don't we have it here where we can look at it?

MR. STEIN: Mr. Thatcher?

MR. THATCHER: I just wanted to ask that. Can we establish some means here by which the conferees can automatically receive this vast amount of information that apparently is being developed?

MR. STEIN: I don't know if we can find the means.

Off the record.

(Discussion off the record.)

MR. STEIN: Back on the record again.

Are there any comments?

(No response.)

MR. STEIN: All right, Mr. Marx.

MR. MARX: I have Mr. Roswell Jones of the Arizona Water Company. I think he wants to make a statement.

STATEMENT OF ROSWELL JONES, CHIEF ENGINEER, ARIZONA WATER COMPANY, 2612 NORTH 16th STREET, PHOENIX, ARIZONA

MR. JONES: Mr. Chairman, conferees, ladies and gentlemen:

Thank you for the opportunity of appearing before you and making a comment for the Arizona Water Company.

Arizona Water Company, operating under the laws of the State of Arizona, is an organized public utility company serving domestic water to the City of Yuma, Arizona, in addition to other State communities. Since its conception in April 1955, Arizona Water Company has served the city and environs treated potable water in accordance with local public health standards and approved direction of the Arizona Corporation Commission.

The source of raw water supply consisted of two locations as of April 1955, i.e., (1) Colorado River in accordance with water rights of 1893, commonly referred to as the Blaisdell rights; and (2) Yuma Main Canal siphon drop in accordance with Contract of June 12, 1945, between the United States Department of the Interior and Arizona Edison Company, Inc.

Total water rights allowed in accordance with the Blaisdell document equaled 1,000 miners inches equivalent to 25.6 cubic feet per second, or 18,500 acre-feet per year. A total annual use not to exceed 250 acre-feet was allowed under the 1945 Contract with the Department of the Interior.

Operations continued through 1957 in accordance with these contracts. In the years between 1957 and 1959, successful negotiations were completed between the United States Department of the Interior, the City of Yuma, and the Arizona Water Company, effecting a satisfactory annual grant of 50,000 acre-feet under Contract No. 14-06-W-106 between the United States Department of the Interior and the City of Yuma. A second contract was negotiated between the City of Yuma and the Arizona Water Company in which the water company agreed to carry out the conditions of the prime contract. Contract No. 14-06-W-106 specifies that the supply will be received from the Colorado River at a point identified as being located "immediately below the downstream edge of the California sluice way at Imperial Dam." It is also specified that the city is to pay a charge of 25 cents per acre-foot for water ordered or delivered under the contract not to exceed 50,000 acre-feet annually, with the exception of the first 10,000 acre-feet contingent upon pending adjudication of the original water right commonly referred to as the Blaisdell rights. Immediately upon approval of the contract by all parties, the Arizona Water Company began taking its supply for the Yuma system from the Colorado River in accordance with contract specifications. Average annual orders have not exceeded 10,000 acre-feet to date since 1960.

In summarizing the events prior to 1960, all governmental agencies assisted most efficiently to assure a satisfactory solution to the Yuma source of supply problem. Sufficient water was available to insure a normal growth which was being experienced throughout the city. The United States Government is to be congratulated also for the assistance rendered in solving the problems connected with the "low river" conditions during 1958. The city, with its water supply threatened, was assured of a potable supply of water free of any contamination harmful to human consumption. Treatment facilities owned and operated by the Arizona Water Company provided the proper treatment.

In 1960, a chain of events commenced leading to the present situation, wherein the Arizona Water Company is paying an additional average annual expenditure of $32,000 for purchased water in excess of the cost planned in accordance with the contract of November 12, 1959, No.

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14-06-W-106, between the Department of the Interior and the City of Yuma. A material change occurred in the mineral content of the Colorado River which reached its maximum detrimental effect in the summer of 1962. The increased mineral content resulted in an increase in parts per million of total salt content from approximately 850 parts per million maximum to a high of 3,000 parts per million. Immediate relief was obvious. The situation ultimately was relieved after extended negotiations and a contract was signed between Yuma County Water Users Association and the City of Yuma for a temporary solution which allowed the Arizona Water Company in agreement with the City of Yuma to receive raw water from the Water Users facilities in Yuma. Receipt of this water, transported through the All American Canal and Yuma Main Canal from the Imperial Dam 18 miles upstream from Yuma and above the confluence of the Gila and Colorado Rivers, assured a potable water supply with salt contents not exceeding 1,000 parts per million. The contract, immediately upon its enforcement, provided a temporary solution. The company reacted immediately and installed necessary facilities on the Water Users Canal at the siphon drop near Yuma to transfer raw water to the company's treatment plant. The contract extended the time to secure a permanent solution for Yuma's source of supply problem through formal negotiations with the Department of the Interior.

Arizona Water Company's additional operating cost to purchase the water from the Water Users Canal at the rate of $ .10 per acre foot equaled approximately $32,000 annually. At the termination of the temporary contract in February 1964, and as a result of continued Colorado River flow past the City of Yuma consisting of excessively high mineral content and absence of a permanent solution to the source of supply problem, the Yuma County Water Users Association approved a new temporary contract with the City of Yuma to provide water at its facility for an extended period of five years at a rate of $4.25 per acre-foot. Arizona Water Company continues to pay an annual charge of $34,400 for purchased water required to satisfy Yuma's needs.

The Arizona Water Company expresses its desire to see that a satisfactory permanent solution be found to the Yuma source of supply problem in accordance with the spirit and purpose of this conference. A permanent solution is mandatory to reduce the hazards of future source pollution. However, the solution must also be related to the ability of the customers of the service area to pay for its water supply.

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In conclusion, until a final solution is found, the company, working for the interests of the city and itself, accepts the present temporary solution.

Thank you, gentlemen, for this opportunity to present this summation and appeal before the conference.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, Mr. Marx?

MR. MARX: Mr. Chairman, at this time I should like to recognize some other Arizonans here.

Mr. Jules Klagge, Director of the Arizona Legislative Council. Are you here, Jules?

(No response.)

MR. MARX: I don't see him. He was here.

There was Harry Gutterman from the Arizona Legislative Council. Are you here, Harry?

(No response.)

MR. MARX: No.

Mr. Bud Bassett of the Game and Fish Department. Do you have a statement you would like to make, Mr. Bassett?

MR. BASSETT: No.

MR. MARX: The Arizona Land Department. Is Mr. Lassen here or Mr. Duncan?

(No response.)

MR. MARX: Mr. William Gookin from the Interstate Stream Commission. He is not here, Mr. Copple?

MR. COPPLE: No.

MR. MARX: All right. That concludes the recognitions, Mr. Chairman.

STATEMENT OF GEORGE W. MARX, CONFEREE;
DIRECTOR AND CHIEF ENGINEER, ARIZONA
STATE DEPARTMENT OF HEALTH, 1624 WEST
ADAMS STREET, PHOENIX, ARIZONA

MR. MARX: My conclusions, I think, I have expressed regarding the uranium problems, the refinery tailings containment problems this morning, and that is one of the things that I am concerned about.

The other thing I brought up this morning was the pesticide problem. We in Arizona have been concerned with the pesticide problem. In fact, it has been of such interest that our last legislature authorized a pesticide control board. This was supported by the agricultural industry, and it has been of real significance in certain areas.

That concludes my summation of this.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. STEIN: I would like to ask you one question, Mr. Marx.

MR. MARX: Yes.

MR. STEIN: How do you feel about this Yuma situation? Do you think that the project should do anything about working on a permanent solution, or stay out of it now?

MR. MARX: I hope a practical solution, one that can be developed economically and satisfactorily to all concerned, can be reached. I don't know just what that would be at this time, but --

MR. STEIN: Well, I suspect, as with everything, that that would come about by negotiation among the interests down there.

The question I have is, can the project staff contribute anything to this, or do you have a recommendation on that one way or another?

MR. MARX: No, I don't have anything specific at this time, Mr. Chairman, to offer.

We are involved in more or less of an international situation here that makes it very hard to express ourselves.

Mr. Copple, do you have something?

MR. COPPLE: Mr. Chairman, are you speaking about the Arizona Water Company problem at Yuma that Mr. Jones spoke about?

MR. STEIN: No. Pardon me, Mr. Copple. The rules of the conference are that only the conferees ask questions or make comments.

We would be glad to have you participate if Mr. Marx wants to call on you.

MR. COPPLE. Yes. Just now he did call on me, Mr. Chairman.

MR. MARX: Do you have any comments on this?

MR. STEIN: No. I was commenting on the proposal made by the Arizona Water Supply that a permanent solution should be reached.

The question that I raised with you is whether it would be appropriate for the project staff to do anything about that, to meet that proposal or not. I gather from your statement that there is nothing specific you would suggest at this time?

MR. MARX: Not at this time.

MR. STEIN: All right. Is that satisfactory?

MR. COPPLE: The only thing I wanted to make clear, Mr. Marx raised the question about the Mexican problem.

The Arizona Water Company problem is a financial problem, because their contract with the United States is for a specific point of diversion, and there is the economic problem of getting from Yuma to that point of diversion, not a question of any water quality at Yuma, because their contract point of diversion, as Mr. Jones mentioned, is above the confluence of the Gila and above any of the drainage water that comes into the river below Imperial Dam.

The quality at Imperial Dam is quite satisfactory and has no irrigation above it, except for many, many miles.

The only thing I want to make clear, so far as the record is concerned, is that the Arizona Water Company problem is not a Mexican problem, as Mr. Marx started to imply, but that is a physical and financial problem of getting from Yuma to the point of diversion that their contract provides for.

MR. STEIN: Mr. Marx?

MR. MARX: That is all we can say at this time, Mr. Chairman.

The problem, as Mr. Copple says, is a financial one at this particular time, and the water quality is satisfactory that the City of Yuma is getting at this time.

The Arizona Water Company would like to have a solution and go back to the original --

MR. STEIN: I can recognize the position. I don't want to prolong this, and we should get out; but again, for the record, I don't want really to throw salt on the waters here.

(Laughter.)

Generally we do think that sometimes it is a solution to a municipal water supply problem, as Mr. White has taken pains to point out at Lake Tahoe on something, that the communities have a relatively high quality source of raw water supply to utilize, that they don't have to utilize water such as some of the rivers that we have to use back East, and go through extensive treatment before it can be made into potable water for a municipal water supply. Sometimes this goes beyond the economic problem of finding a place to put a pipe, but this is just for the record.

We will recess for five minutes before we take up the conclusions.

(Whereupon a recess was had.)

Closing Statement

MR. STEIN: May we reconvene?

I think the first issue we might take up is the point brought up by several of the conferees about the preparation by the project staff for submission to the Technical Committee and the conferees of a set of basic principles to be used in the formulation of a comprehensive pollution plan. This comprehensive plan is to take into account other factors in addition to those of salinity and radioactivity now being considered.

I think that the plan should be developed and sent to the conferees -- and check me on this, Mr. Rademacher -- within two months from today.

MR. RADEMACHER: Two to three months, at the most.

MR. STEIN: No.

MR. RADEMACHER: All right. Two months.

MR. STEIN: Two months from today, because if we cannot resolve the plan by comment, we very well may have a rather early meeting of the Technical Committee. In view of some of the effects of the economic study, I think we need a relatively clear statement of principles right away. I have always regarded the economic study as just one tool, but from reading or listening to some of these statements, I can appreciate the reaction of Mr. Williamson and Mr.

Bonderson and others to the statement.

Then possibly within several weeks after that, if it is considered appropriate, we might consider calling the Technical Committee together, because I think there are several other points to be taken up with this Technical Committee, which would indicate that an early meeting is in order.

The next point is that out-of-basin service areas are to be included in the economic evaluations and in relation to the effects of salinity and other pollutions, in order to give a complete picture of the area.

At this meeting of the Technical Committee, would it be possible for the project also to outline, at least in general terms, which of these out-of-basin service areas would be appropriate for inclusion, so that again we would be able to move forward without any misunderstanding about it?

MR. RADEMACHER: At the next technical meeting?

MR. STEIN: At the next technical meeting, which I suspect very well might be about three months from now.

MR. RADEMACHER: Right.

MR. STEIN: The next thing I think that will have to be reevaluated -- and this will depend upon budget and availability of equipment and resources -- is the question of what we are going to do about the pesticide problem in relation to water pollution in the Colorado River Basin.

I would suggest that a full report on proposed pesticide activities be prepared for the consideration of the Technical Committee too. This is just an indication of what will be done.

Also, I think we should take Mr. White's admonition -- and I believe this was alluded to by Mr. Copple too -- that the pesticide problem is here and it is just on top of us. In the water pollution control business, we are just going to have to face up to it immediately.

Mr. Bonderson?

MR. BONDERSON: I wonder if you could modify that just slightly?

MR. STEIN: Yes?

MR. BONDERSON: That is that in a report and evaluation and program on this there be a little thought given to defining the problem as it relates to an interstate implication.

MR. STEIN: Yes.

MR. BONDERSON: Is this really an interstate problem, or is it an intrastate problem, or is it both? The report should sort of give a little bit of the definition of what it is.

MR. STEIN: I would like to make this clear.

This is one of the reasons why, before the new techniques were developed in pesticides, we didn't give this the highest priority. It appeared that the pesticide problems which were developing were relatively local problems and not interstate.

The point is that we would not get into any pesticide problem that was intrastate in nature without the specific request of that State. As you know, this fits in with our general policies, and this should be made very, very clear. Sometimes it has not been understood.

Let me say that our jurisdiction under the Federal Water Pollution Control Act -- and this case is one under that section -- deals with pollution originating in one State endangering health or welfare of persons in another State. We cannot get into an intrastate situation except upon request of the Governor of that particular State.

Let me go off the record.

(Discussion off the record.)

MR. STEIN: Let us go back on the record.

In addition to that, we should have a report by next year for the conferees, because this may take a little more time than the three months, in somewhat more detail, on the phasing out of the project, because I think the time has come now when we can see daylight and should be able to determine when we are going to complete our work.

It has been proposed that we investigate and report on losses to recreation and fish from the lowering of Lake Mead and Lake Powell.

I recognize that the project will not be able to do this within its existing budget and resources. Again, if this is a recommendation of the conferees, we had agreed, when we set up this new budget, that when requests or aspects of that sort came up in the program, we would try to augment the staff from our Cincinnati laboratory, the same as we would handle any other study.

If the conferees agree, we can take that as a charge from the conferees, with the understanding that we will have to get extra staff to do this.

Is this agreed to by the conferees?

MR. ROZICH: I can't see how this is related to water quality. This is water quantity, not quality.

MR. STEIN: Mr. White?

MR. WHITE: This is true. Water quality is involved with water quantity.

MR. ROZICH: Correct. It goes back to my statement that it would be at the expense of the Upper Basin States.

MR. WHITE: So what?

Closing Statement

MR. STEIN: Let me put it this way: If the real reason is that we shouldn't do it because it is outside the purview of the conference, that is one thing; but if the view is that we have an upper State-lower State hassle, I think this possibly should not enter into our consideration.

As I understand this, we have this proposal from two of the States, Utah and Nevada, who both want this study. I would like to, in a sense, see if we can move on and get the sense of the conferees on whether we would engage in this or not.

How do you feel about it, Mr. Williamson?

MR. WILLIAMSON: I don't think we have anything to say about how they manipulate the water levels in those two reservoirs, because there is a very binding agreement back with these other water agencies that if something happens some place, they are probably going to go to court on it, because there is a matter of quite a few dollars involved between the upper States and the lower States, whether any power is generated up there or not. I mean, I don't know whether we could have any meeting of the minds as to even looking at this thing.

This is strictly an agreement between upper and lower States, and what the water will be used for.

MR. STEIN: I want to make this clear. I don't think our study would have anything to do with any agreements or any water allocation.

As I understood the proposal, the only point was to investigate losses to recreation and fish in Lake Mead.

MR. WHITE: He was talking about losses to fisheries, to recreation, and the effects on the domestic water supply of this area resulting from uses of water upstream and reducing of volumes.

These are legitimate uses, and these are going to be real problems.

MR. STEIN: I think that stated it better than I had. I think you have expanded it somewhat.

MR. WHITE: You have humans involved in it. You have every downstream user who is using this water.

MR. STEIN: Speaking for us, we don't have any objection, but I think we want to reflect a consensus of what the conferees would want to do on this.

MR. WILLIAMSON: As Wally stated it there, it is not objectionable. I mean, he wants to study the effects on recreation essentially and on municipal uses of the upstream users.

MR. STEIN: This isn't all he said.

Let me restate it, as I understood it, so that this is crystal-clear. Mr. White mentioned the effects on recreation, domestic water supply or public water supply, and fish and fishing, in Lake Mead and Lake Powell from upstream uses of water and the reducing of volume.

MR. WILLIAMSON: This is perfectly all right.

MR. STEIN: Is this all right?

MR. WILLIAMSON: This is all right.

MR. BONDERSON: Mr. Chairman?

MR. STEIN: Yes.

MR. BONDERSON: This may be all right so long as it is clearly understood that this evaluation is confined entirely to quality implications.

MR. STEIN: I don't think we have any jurisdiction other than that.

MR. BONDERSON: Let's have that clearly understood.

MR. STEIN: Let me make this clear: Whatever the conferees may feel about other than pollution or quality implications, we have no authority under our statute to go beyond that, and we not only wouldn't, but we couldn't. This has to be made abundantly clear. That is all we are here for.

MR. WHITE: I have no objection to using the word "quality" because quantity has a bearing on this. It is inseparable from it. You will have to include it, but

I will leave it limited to quality.

MR. STEIN: All right.

MR. ROZICH: May I ask a question? Is this to be included in Dr. Wollman's economic study?

MR. WHITE: No.

MR. STEIN: No, sir. We will presumably get a group of people who specialize in recreational uses of water, including aquatic biologists who specialize in fishing, and some of our experts who examine the water quality for domestic water supplies and see what the results are. They would prepare a report the same as they prepare a report in any situation for the consideration of the conferees.

As a matter of fact, I don't think this is a particularly exotic request. This is the kind of thing we do all the time, it seems to me.

MR. WHITE: Surely.

MR. STEIN: All right.

Now, if we can get to the next point, this is a continuation of what was decided last time, that the project staff will assess the nature and magnitude of the salinity build-up in the mainstem of the Colorado River and its tributaries, investigate and evaluate feasible methods of controlling and minimizing salinity concentration loads in the river, and evaluate the net basin-wide economic benefits associated with various degrees of salinity control.

I don't know whether we should not eliminate that third one completely and leave the first two. Do you want me to read them again?

Assess the nature and magnitude of the salinity build-up in the mainstem of the Colorado River and its tributaries, and investigate and evaluate feasible methods of controlling and minimizing salinity concentrations and loads in the river, which is a continuation of what they have been doing.

Now, I would suggest that the conference staff make arrangements through its radioactivity consultant to have the project to get a report on the tailings, whether in ponds or in tailing piles, in detail, one by one, of every pond and every tailing pile in the basin, to indicate what the prognosis is for the people in this basin for living safely with that in the future, whether it is going to create any hazard, or whether any remedial work has to be done, and what that work has to be. That should be done by the time of the next conference.

Again, there has been a proposal that we should evaluate uranium damage to fish. This is presumably non-radioactive, the uranium damage to fish.

Again, if this is done, we will have to enlist the aid of an aquatic biologist from Cincinnati to come out and try to do the work, just as they have done this in evaluating the effects of any other alleged contaminant on the fish.

MR. WILLIAMSON: I might say, as a reference, the Game and Fish Department in Wyoming has made considerable studies on uranium in water and the effects on fish, so if this is what they are looking for, they can get a lot of information.

MR. STEIN: That's right.

I would like to make this very clear, both as to your States and as to any of the other local governments or Federal Departments.

We have a load of work to do throughout the country, and we never have enough money. One thing we don't like to do is duplicate work or do work that we don't have to do.

If the records are available and the data is available, we will gladly use that data.

Sometimes we are teased a little for using a lot of other people's data, but I think that is a saving to the Government. If other people have done the work, I don't think that the Congress expects us to spend the money again and do it over again. We will be glad to use your data.

On the other hand, I should indicate that we have a statutory obligation to perform. In the past, when we have attempted to get data and the data was not available, we just had to do it ourselves.

In dealing with one of the large industrial Eastern States recently, we could not get data from the State on industrial loadings or specific industrial loadings, even though industry was not opposed to this. As a matter of fact, almost all industry was appalled by the attitude.

However, when we could not get the data, we had no alternative but to put a crew in the field and get this ourselves.

Once we take on a project, if we are going to carry out our statutory obligation, that is what we are going to do.

I would suggest too that our consultant on radioactivity matters, in cooperation with the AEC, get together with the Mexican Hat, Utah, mill of the AZ Company, and the mill at Rifle, Colorado, of the Union Carbide Nuclear Company, and see if the mills, the AEC and our people, all can't agree on a proposal for any remedial action which may be forthcoming or may be called for at the

Mexican Hat and the Rifle, Colorado, mill, and report the progress as to that at the next meeting.

I might also say that I would strongly suggest, just speaking for the Chair here, that Mr. Beverly's statement be taken into account, and that when you talk about procedures or alleged damages caused by the tailings and ponds, if any, or what has to be done, that at the earliest possible moment the representatives of the mills be brought into those discussions.

From my point of view, the earliest possible moment might be the first meeting.

MR. THATCHER: Mr. Chairman, our Water Pollution Control Board would also like to be involved in the case of the Mexican Hat mill.

MR. STEIN: Yes. I think in all these cases, where you are dealing with a mill in a State, the State agencies or representatives should be involved in the discussion and the agreement.

I don't have anything else. Are there any other comments or questions?

(No response.)

MR. STEIN: Does anyone in the audience want to say anything?

(No response.)

Closing Statement

MR. STEIN: If not, I would like to thank you all for coming and participating.

The conference will stand adjourned subject to the call of the Chairman.

(Whereupon, at 5:35, the conference was adjourned sine die.)